Volume 60

# American Machinist

New York, May 22, 1924

Number 21

# A Workable Production Control System

**By Edward Davis**

Production Manager, Edison Phonograph Works

First of a series of articles describing a recently developed control system — Essential features — Control based on periodic inter-departmental shipments of predetermined amounts of material

IN ATTEMPTING to describe a production control system for publication, the writer is aware of the skepticism with which the average factory executive usually regards a plan developed in and for a certain plant. The usual, and quite natural, thought is that almost any system may suit the conditions for which it is developed, but that the results generally prove disappointing when the plan is transferred to another place.

While I do not believe that the perfect production control plan is with us yet, the system presented here has many features that entitle it to consideration. Of these, perhaps the most important are its adaptability for small or large plants doing a variety of work, and the fact that it may be installed at any time anywhere, without affecting the operation of the factory in any way.

The phonograph works of the Edison Industries, Inc., Orange, N. J., shown in the headpiece of this article, utilizes about one-half million square feet, or twelve acres, of floor space. At this plant are manufactured and finished, ready for assembly, all but the wooden cabinet parts for thirty styles of musical phonographs, and these parts, when finished, are shipped in complete sets to the cabinet plants. These plants make the wooden cabinets complete and assemble into them the parts received from Orange. The two main assembly plants are situated at New London, Wis., and Silver Lake, N. J. Cabinets made at other points are shipped to these two plants for final assembly. In addition to the musical phonograph, the Orange plant manufactures fifteen different styles of Ediphones or business machines.

The manufacture of the forty-five different types of machines involves approximately 6,000 separate parts, on which are performed an average of 6 operations each, or 36,000 complete operations. To meet our present schedule we require about 10,000,000 individual pieces or parts per month, and must necessarily perform 60,000,000 operations in order to complete them.

At least 8,000,000 of these pieces must be brought through one or more of the twenty departments at Orange on schedule, and must arrive at the shipping department at a specified time to be packed and shipped to the final assembly plant in carload lots. Each car contains a predetermined number of complete sets of parts, depending upon the types of phonographs sched-

*Fig. 1—Departmental stock room*

uled for finishing at the plant to which the car is to be shipped. These cars cannot leave if any parts are missing; neither can a car be held beyond the time it is scheduled to leave, without the danger of paying demurrage on the car and delaying production at the finishing plant. Moreover, the cars cannot be sent out too fast, or they will cause much confusion at the other end, since the assembly plant must stock parts for which they have no immediate use, a proceeding that means an unnecessarily large inventory and possible double handling, which is always costly.

It is apparent that production control at the Orange plant is absolutely necessary in order to co-ordinate the operations of all the various manufacturing departments, so that the required parts can be brought through the plant in the most economical manner, consistent with the high standards for the product set by Mr. Edison.

The Phonograph Works has always had a production control system of some sort, and all of them probably had some good features. But every one of the systems used, as far back as I can remember, made use of the

*Fig. 2—Departmental inspection room*

"stock chaser" or production follow-up man, an arrangement that was always a rather costly proposition. It was found that the more of such follow-up work was done, the more it was necessary to do, since the department heads and the stockkeeper naturally got into the habit of depending upon the follow-up for information.

We tried dividing our product into several classes, such as cabinet hardware, cylinder records and parts, disc records, phonographs, parts, etc., and then placed a man in charge of the follow-up of each class of material to facilitate its passage through the several departments as required. Of course, each follow-up man wanted his parts first, and would not hesitate to ask the department superintendent to break up a job on a machine to get out a small quantity of parts that were wanted in a hurry. This caused endless arguments between the follow-up man and the department head and, due to the frequent breaking up of jobs, a comparatively higher cost.

I believe it is a common experience that, on a big job on which there are several operators doing the same work, the least trouble is experienced. Such jobs seem to run along without much urging, but the short runs, where it only takes a few hours or days to complete a month's supply of parts, must be continually watched. We have found that the more these jobs are followed

December 1st 1923.

Drill Press Department

SCHEDULE

The following schedule is to take effect at once and continue until further notice.

| Part No | Part Name | PerDay | PerWk | 13-Wks |
|---|---|---|---|---|
| 74004 | Top Plate | 1000 | ---- | ---- |
| 73620 | Bracket | ---- | 2750 | ---- |
| 72780 | Pulley Clutch | ---- | ---- | 3000 |
| 75910 | Clutch | ---- | ---- | 5000 |
| 52435 | Bearing Sleeve | ---- | 2500 | ---- |
| 84100 | Repeat Cam | ---- | ---- | 1200 |

Production Manager.

C. C. to Gen. Supt., Chief Store-keeper (2), Chief Inspector, Raw Material Stores, Accounting Dept., Files(2).

*Fig. 3—Schedule sheet for drilling department*

up, the more attention they continue to require, and there is always the danger of over-production. The failure in this method of follow-up can be summed up in a very few words. In the first place, no matter how conscientious the department head may be and regardless of how carefully he plans his work, there is always the danger of a stock chaser running up to him at the last minute and requesting immediate action on some part that has been overlooked. Second, it is easy to get into the habit of waiting for somebody to tell you when to start a job.

Of course, I am judging entirely from my own experience. I have found, in making investigations as to the reasons for a department falling down on the production of a part, that I would invariably get the answer, "Well,

the stock chaser didn't tell me that we were short on that. I thought I had put through plenty to take care of the schedule." Such a remark from a department superintendent shows the old situation clearly and, during the period I speak of, the production department had a personnel of about 40 people.

**SHOP ORDER No.**

To Foreman_____ Dept. Date_____ 192__

Proceed with the following work in strict accordance with the drawings and specifications provided and charge workman's time to this order number.

| Quantity Ordered | Name of article | No. |
|---|---|---|
| Quantity Cleared | | |

Special Instructions

Note: - Department Superintendent and Storekeepers will be held responsible for the observance of the above instructions.

Edison Phonograph Works

Production manager.

Deliver this Order to the Production Department when your work has been completed.

| Copies Issued To | Deliveries Required |
|---|---|
| | IMPORTANT<br>FIRST DELIVERY MUST BE COMPLETED ON THIS PART<br>BY.....<br>SHOP ORDER FINISHED<br>BY..... |

*Fig. 4—Shop order form*

After the World War, when we got a slight breathing spell, we decided that the stock-chasing system did not give us the results wanted, and a thorough analysis of our production problems served to indicate the essential features and requirements of a system that might be

*Fig. 5—Control board in department stock room*

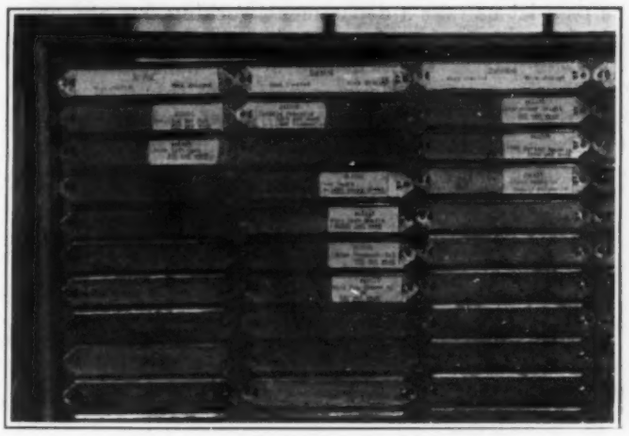


*Fig. 6—Corner of control board*

installed with some prospect of successful operation. This study showed us that the essentials of a good production control system should be as follows:

(1) The system must be workable and practical, with as little red-tape as possible.

(2) The records must be accurate and timely, that is, the record of a transaction must be available in a short time after the work is done.

(3) All data, orders, and records must be susceptible to a careful, easy and accurate check.

(4) The clerical force required to operate the system must be as small as possible.

(5) The number of forms necessary for suitable orders and records must be kept small, so that a great quantity of different reports and records will not complicate matters.

(6) Sufficient flexibility must be provided so that the production of a great variety of work in large or small lots may be controlled.

(7) The system must be simple, so that it will be readily understood by every member of the organization.

The reader will realize that we gave ourselves a large order when we looked for a system that would include all of these features, but a rather novel idea finally presented itself. The basis on which the new system is constructed is the control of shipments or transfers of predetermined amounts of material between departments, these shipments to be made at periodic or stated time intervals. This means that each part in process is scheduled to leave a department periodically and each shipment contains a certain number of parts, depending on the requirements.

It should be mentioned here that all departments are more or less segregated in this plant, each department having its own stockroom and inspection room. A departmental stockroom is shown in Fig. 1 and is in charge of the departmental storekeeper, who handles the material and makes the shipments. A departmental inspection room is illustrated in Fig. 2, and is in charge of the department inspector, who reports to the chief inspector of the plant.

As an example of the operation of

the plan let us take a department working five and one-half days per week and requiring 500 pieces per day of a certain part. The schedule of the department performing the next previous operation on this part would state that 500 pieces were to be shipped each day, unless it were such a small part that economy in operation might have made it advisable to have larger quantities

INTER-DEPARTMENTAL SHIPPING TICKET

EDISON PHONOGRAPH WORKS

NO. BOXES IN LOT _____ TICKET NO. _____

TO _____ DEPT. DATE _____

PART NO. _____ PART NAME _____

MATERIAL OR LAST OPERATION NAME _____

NEXT OPERATION NAME _____

QUANTITY _____ DELIVERED BY _____ STOREKEEPER

PRICE PER { FEET / POUNDS / PIECES _____ _____ DEPARTMENT

EXTENSION _____ RECEIVED BY _____ STOREKEEPER

FROM LABOR TICKET NO. _____ _____ DEPARTMENT

ORIGINAL

THIS COPY TO GO WITH MATERIAL

*Fig. 7—Inter-departmental shipping ticket*

on hand to operate on at one time. In this case the schedule might call for 2,750 pieces per week, 5,500 pieces every two weeks, or longer periods if necessary. The determination of amounts and time of shipments will be taken up in detail later.

For the present we will sketch the fundamental and controlling features of the system as it is now in operation, so that the reader may gain a general idea of the

*Fig. 8—Master shipping control book in use*

whole plan in operation and the various physical records by which the work is done.

Before production can be controlled it is, of course, necessary that it shall be planned. The routing of all parts through the various departments is done by the engineering department, which also furnishes all information regarding a part and how to make it. These route sheets and blueprints are on file in the production department. Orders for phonograph parts are received by the factory from the sales department in advance of its requirements, such orders, after approval by the management, being turned over to the production department. This department then issues the necessary instructions to the shop so that the work can be started, the instructions being based on the engineering data in the files.

These instructions or orders to the shop are divided into two classes—schedules and shop orders. The schedule, a sample of which is shown in Fig. 3, is the official notification to the department head that beginning with a certain date he will be expected to produce the number of finished parts as outlined on the schedule, and be ready to make deliveries to the next department in daily, weekly, or monthly shipments, as specified.

A shop order is made out on the form shown in Fig. 4, and is used where bulk or raw material has to be cut up into parts. It gives authority for the department to which it is issued to make the number of parts called for, and also authorizes those in charge of the raw material stockroom to issue the amount of stock called for on the order. The shop order is issued only to the prime department, that is, the department performing the first operation on the part, and copies are sent to the stockkeeper, chief inspector and accountant. If the second operation necessary to finish the part is a simple one, however, such as parkerizing, bluing, nickel flash, etc., the department head in such a department would also get a copy, so that he in turn could put the entire lot through at one time. As a rule, this happens only on such small items as screws and washers, where the second operation is performed in bulk, and the only exception made to this rule is when a comparatively small number of parts are required to take care of a year's production. Then, in order to make the operation as economical as possible, shop orders are issued to each of the departments operating on that piece, and no shipments are made between departments on this shop order until the entire quantity is completed.

### Production Control Board in Each Department

One of the most important features of the system is the production control board. One of these boards is located in each department of the works and is placed in a conspicuous position, generally in the stockroom, as shown in Fig. 5, where it is readily accessible to both the stockkeeper and the department head. A closer view of one corner of this board is given in Fig. 6, and illustrates how cardboard slips bearing the part numbers, names and quantities to be shipped of all the parts that appeared on the production schedule are placed on the face of the board in convenient holders. These boards, as will be explained in detail later, are the means of keeping a visual record of the interdepartmental shipments as they are made. An inspection of a board at any time will show the status of all work in the department, and the information is available for anyone who may be interested.

It is necessary that the production department shall also have a record of all interdepartmental shipments for control and checking purposes, and the data for such records are carried to this department by a copy of the interdepartmental shipping ticket shown in Fig. 7. As each lot of parts is produced, inspected and turned into stock, it is counted and, if the control board shows that it is time for a shipment to be made, one of these tickets is made out and placed with the shipment. A shipment is never made unless the full amount called for on the schedule is available, as the stockkeeper cannot ship more or less than the specified amount. This rule is

strictly enforced, for reasons that will appear later on.

The production department records include a part record card and a master shipping control record book. The part record card carries a complete history and description of the part, together with all the data necessary when issuing schedule sheets or shop orders. A record card for each part made at the Orange plant is on file in the production department.

The master shipping control book is shown in use in Fig. 8. This loose-leaf book contains a sheet for each department operation on each part, the sheets overlapping so that they are visibly indexed. The sheets are placed in the book in numerical order according to the part numbers, and the sheets for the variation operations on any part are placed according to the routing. The interdepartmental shipments are recorded in this book from the shipping ticket data, and this record forms the master check for the operation of the system.

It will be apparent to the reader that no mention of the control of individual operations has been made and, although production control without such procedure may seem impossible, it is unnecessary with the system outlined above. This interesting feature will be discussed in the next article.

# What to Make in a College Shop

By Entropy

THERE is no end to the possible discussion of this subject, but it is possible to limit it by deciding, first of all, what students go to engineering schools for, and then discussing only the kinds of work that help them to reach their goal.

As I see it, the engineering student is usually in college with a very material end in view. He expects to make money; enough at least, so that what he or his parents spend on his education will pay back sufficient dividends to cover the cost in a short time, and then pay better and better dividends as long as he is in active mental condition. There is no other business in the world that is expected to pay so large dividends as education, and incidentally, no other where the persons who conduct the business get so little of the dividends for themselves.

One of the things that will help a graduate to sell his services is a sufficient knowedge of manufacturing methods, to enable him to so design machinery that it can be built efficiently; so that it will be strong enough and do whatever work it is designed for. The matter of strength and design can be taught in a general way in the class room and over a drafting board, but the ability to design for efficient production can only be absorbed through dirty hands and tired muscles. It is doubtful if the usual run of "exercises," or the manufacture of a few bench lathes, gives the graduate the knowledge that he requires. It is doubtful if the manufacture of any one article or machine will give that practice. What is there, then, that the students can do that will give them practice in right methods of manufacture?

### Experimental Basis for Shop Work

In the laboratory they try experiments; they break beams; they crush columns; and they twist shafts. They may all try the same experiment that has been tried each year for the past twenty years, but each experiment is new to the student when he is trying it. Each one draws his own conclusions from his own experiment. Likewise, in the school shops each man needs to try his own experiments; he needs to turn a shaft without any center support; he needs to turn it with a center rest, and with a follow rest. He needs to draw his own conclusions as to when it is best to use the one or the other, and when to use neither. He needs to turn a light pulley on a mandrel merely dogged to the face plate; and he needs to turn the same pulley driven by studs secured to the faceplate, observing the difference and expressing an opinion as to how many pulleys he should have in the lot in order to make it pay to rig up the studs.

These are simply illustrations. He does not need to acquire dexterity of manipulation. He should do enough scraping to learn its difficulties and its possibilities, but he does not expect to become a scraper hand. Every job should be an experiment. The boy in a trade school should learn to handle tools with dexterity; the college man needs real dexterity in the handling of drawing instruments, mathematics and English.

It is difficult, if not impossible, to mention any one small machine that will give a balanced division of the different machine shop experiments which a student should perform. It is probably necessary to make a great many machine parts in order to illustrate a fair percentage of the different cases, because the majority do not belong to any one machine. It is quite necessary to study every type of operation that occurs in production; not merely certain types of lathe work, but bending, press and punch work. All of these are quite as important to the young graduate as the standardized drilling, turning and milling processes.

It is my belief that the best way to secure this work is to make arrangements with some established firm. Just such parts of standard machines as are adapted to the necessary experiments can be secured for machining, and the boys can then be sent out to the shop for assembling practice. Here they can get enough practice in assembly, so that they will allow for assembly time when they come to figure on jobs.

## Low Flash Point Oils for Air Compressor Service

While there has been considerable controversy among engineers in the past regarding the relative merits of high and low flash point oils for air compressor service, research has practically settled this point of argument decisively in favor of the latter, according to *Lubrication*, published monthly by the Texas Co. It has been proven that high flash and fire points have been decidedly over-emphasized in their relative importance as qualifications for air compressor lubricants. In fact, observation of the conditions under which explosions will tend to occur has further developed that high flash points will practically always lead to the greater formation of deposits which are known to be dangerous. Therefore the air compressor operator should make sure at all times, that he is getting a proper and sufficiently low flash point compressor oil; in other words, he should specify that the flash be below 400 deg. F.

# Famous Machinists of History

By H. H. Manchester

## *John Bunyan (1628-1688)*

JOHN BUNYAN was born near Bedford, England, in 1628. His father, Thomas, has sometimes been called a tinner, but described himself as a brazier. There was an essential difference. The tinners went from place to place mending brass, copper, and tin ware, but a brazier had a fixed shop where he manufactured copper and brass utensils. In doing this he used a lathe on which they were turned while being worked over, much as the vase was turned on a potter's wheel.

*John Bunyan*

John grew up into his father's occupation. In after years he wrote of himself as a brand snatched from the burning and the wickedest of mortals, but, as a matter of fact, he seems to have been a model young man who stopped swearing on the first reprimand, and whose only vices were a few youthful sports.

At seventeen he entered the Puritan army, and gathered there his knowledge of military affairs which he afterward used in "Pilgrim's Progress."

In 1646 he returned home and went on with the business. Two years later he married, his wife bringing him some pious books as her only dowry.

His shop at the time was in a lean-to joined to the stone cottage at Elstow, where he and his wife lived. It included a little foundry for casting, a foot lathe for turning, and a forge, anvils, and various tools.

Soon after this his abnormal imagination, spurred on by the Puritan doctrine of hell, drove him to near insanity. He believed he was one of the damned, and saw all sorts of fearful visions.

In 1655 he moved to Bedford and set up his shop there. The next year he got into a controversy with a Quaker, and published his first pamphlet entitled "Some Gospel Truths Opened."

In 1657, urged by several members of the church, he began to preach as a nonconformist. After the restoration of Charles II to the throne in 1660, it was made unlawful to preach anything in England but the doctrine of the state church. Bunyan was arrested and put in the jail at Bedford, where he was confined somewhat loosely for the next twelve years. During this time he supported his family by working there, and in 1666 published his "Grace Abounding."

He was again imprisoned for six months in 1675, within which term he finished the first part of "Pilgrim's Progress," which was published in 1678.

This became amazingly popular and made him a highly influential man.

He published "The Life and Death of Mr. Bad Man" in 1681; the "Holy War" in 1682; and the second part of "Pilgrim's Progress" in 1684. Of all his works "Pilgrim's Progress" is by far the most famous, and is perhaps the greatest allegory in any language. It has been translated into some seventy different languages.

Bunyan died in his sixtieth year as the result of a cold caught on a ministerial visit.

# Why Do We All Try to Bluff?

By John R. Godfrey

Some of our European friends (?) often refer to us as a nation of bluffers. While I am not sure how far they play the same game, there is all too much truth in the statement, although it may not be in exactly the way they intended.

If we are building a house or shop and desire to move in about the first of May, we invariably draw the contract so as to make the builder promise completion by January 1. By allowing four months we feel pretty safe that it ought to be done by the time we need it. The builder, on the other hand, knows perfectly well that we do not need the building by January 1 and that we do not expect it much before the first of May, and he plans and works accordingly. The building would probably be done just as quickly if we told him frankly we did not need it until May 1, but must move in on that date, and it would save considerable bluffing on both sides.

When the shop superintendent puts in a requisition for new machinery, he usually knows from past experience that some of the machines he asks for will be cut off the list. That is frequently the only way the man in the purchasing agent's office thinks he has of showing the directors that he really earns his money. So the superintendent requisitions all the tools he really needs and then adds a few more at fancy prices. These he will relinquish after a protest, so that the office man will feel that he has really effected an economy for the company. In other words, the shop superintendent is compelled to bluff by adding unnecessary tools to the list as a sacrifice, in order to secure the things he really needs.

We have not yet reached the point where we can overcome this tendency to bluff, and we feel that it is necessary to make the salesman believe we do not care whether we buy a machine or not, in order to influence his price or secure other concessions. We believe that if we are not too anxious for a contract we are more apt to secure it on favorable terms, and there are hundreds of other ways in which we are continually bluffing, usually fooling nobody but ourselves.

One amusing incident of the purchasing agent variety comes from a concern where the shop man talked very strenuously for a power hack saw. The purchasing agent felt this to be an opportunity of showing his practical (?) knowledge, and so he cut out the power hack saw and suggested that a saw frame be attached to the ram of a large shaper in such a way that it might be used in place of a hack saw. It did not require much argument, however, to show him that this was not an economical arrangement, and a power hack saw was replaced on the list of machines to be bought.

# The Use of Fixtures in Disk-Grinding

**By Howard Campbell**
Western Editor, *American Machinist*

## Grinding production determined largely by types of fixture used —Some recently developed work holders—Grinding piston rings automatically—Better work and higher production with less labor

THE DISK GRINDER has so definitely made a place for itself as a high-production unit that the attention of the designers has become focused on one point—means of getting the work to the grinding wheel as fast as possible. The necessity for accuracy as well as speed has required the use of fixtures to hold the work, therefore the disk grinders of today are designed so that fixtures can be easily applied. The illustrations herewith show some of the later types of fixtures in use with Gardner grinding machines.

The operator shown in Fig. 1 is grinding copper contacts for elevator control equipment. The contacts are 1¾ in. in diameter, which is equal to approximately 2½ sq.in. of area. Approximately 0.015 in. of stock is removed in one cut, the requirements being only that the surface be flat and smooth. A fine-grain, heavy-type disk wheel is used, which can be adjusted to compensate for wear by means of a micrometer adjustment. Eight fixtures are used, one on each side of the eight-sided work-drum, and each fixture holds two pieces. The fixtures are of the cam-action type, which makes it easy for the operator to load and remove the work. The work-drum revolves continuously and a set of change gears is provided so that the speed of the drum can be changed as desired, according to the job that is to be done. The production on this job with the equipment shown is 575 pieces per hour.

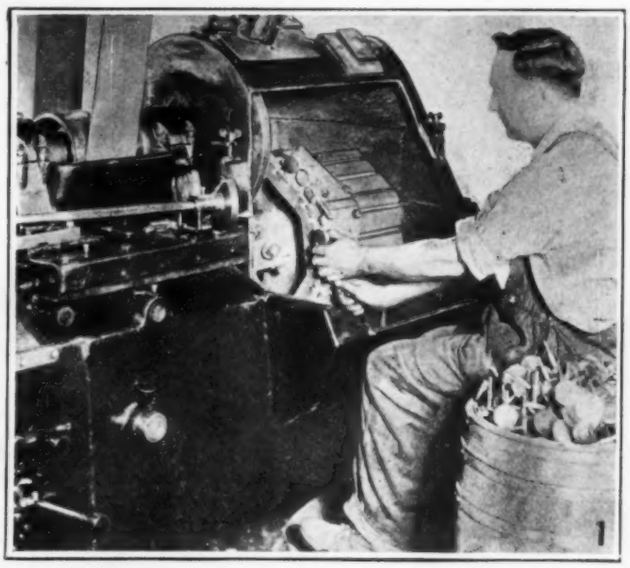
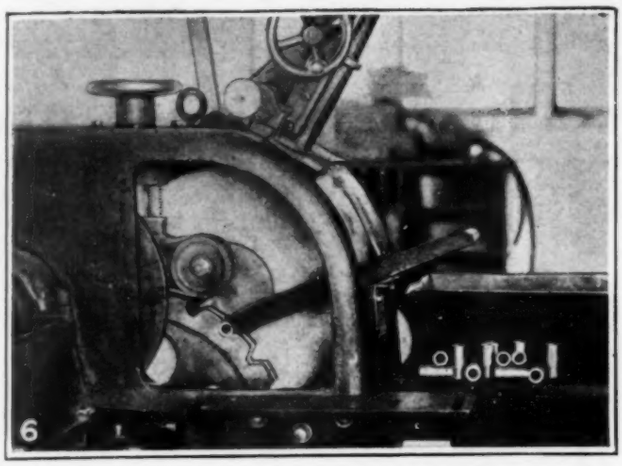


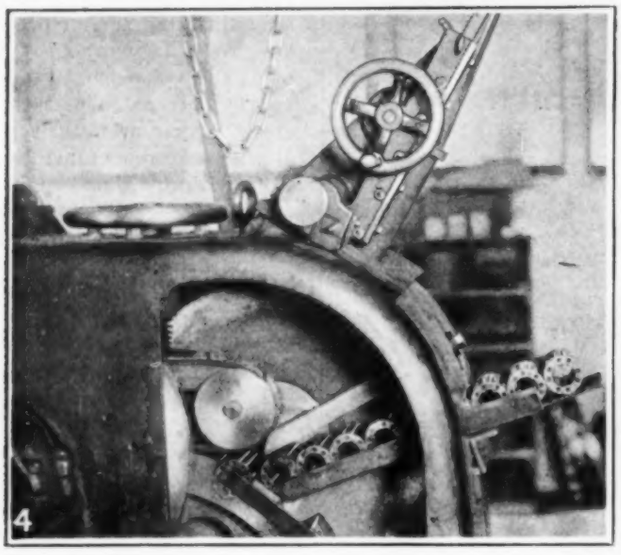
*Fig. 1—Both speed and accuracy are features of this machine*

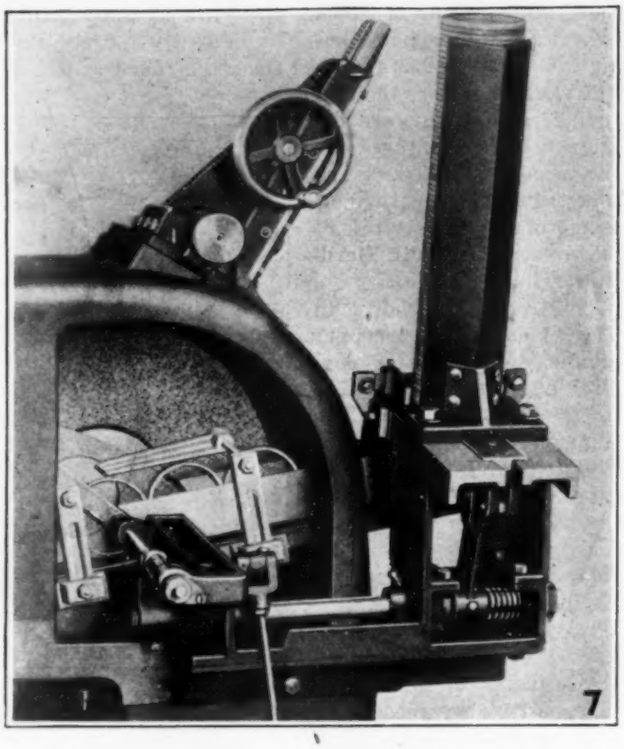
The operation of grinding the faces of bearing caps for Chevrolet motors is shown in Fig. 2, using an 18-in. semi-automatic machine with a 12-grain, heavy-type G. I. A. disk. The eight fixtures are of the cam-action type, each piece being held by a hook that is operated by a lever on the fixture, as shown in Fig. 3. Raising the lever pushes the hook ahead, compressing the spring and releasing the pressure on the piece so that it can be removed. Only enough stock is removed to "clean up" the surface—approximately $\frac{1}{64}$ in. The production on this operation is 600 per hour.

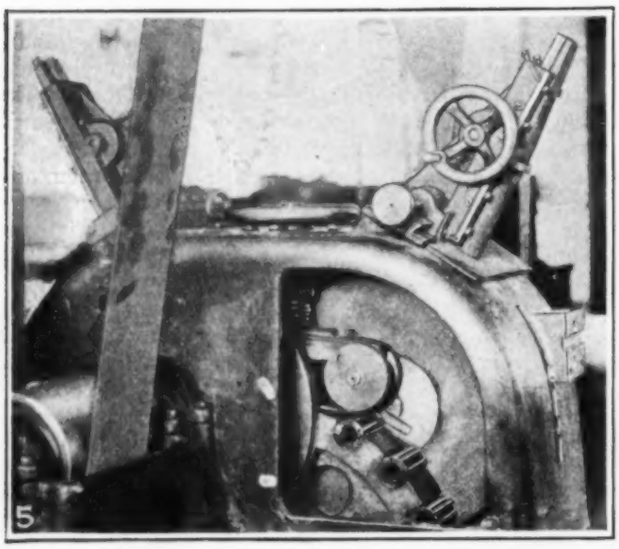
The illustration, Fig. 4, shows the operation of grinding the end plates on roller bearing cage assemblies. The machine is a Gardner No. 2 automatic double grinder, having two disks with the work-carrier between. As the work approaches the grinding position, one of the disks automatically advances until it reaches a positive stop. It then approaches the work under an adjustable spring pressure that is governed by a cam, and consequently advances only as fast as the stock is removed, a constant pressure against the work being thus maintained. The disk is returned to the open position by the action of the same cam. Approximately 0.015 in. of stock is removed as it is only necessary to true up the plates after the rollers are riveted in. The cages are placed by hand in a chute through which they feed by gravity to the work-wheel as shown in the illustration. Immediately after leaving the chute and before passing between the disk wheels, the cages pass under a ¼-in. steel cable, which serves to hold the pieces in the wheel. The cable can be adjusted for tension by means of a hand wheel. As the cages leave the disk wheel on the opposite side of the machine, the cable releases them and they fall out of the rear of the machine into a receptacle. Forty-two per minute can be ground in this manner.

The same type of machine as that described above is shown in Fig. 6, grinding the ends of 1 in. dia. bronze bushings. The amount of stock to be removed varies from $\frac{1}{8}$ to $\frac{1}{16}$ in. and the bushing is held to a limit of 0.004 in. The work-drum has 24 openings and the pieces are held in by a cable-clamp, as described in the preceding paragraph. Two cuts are required, $\frac{3}{32}$ in. being taken off in the first cut and $\frac{1}{32}$ in. in the second. If the amount of stock were cut down to $\frac{1}{16}$ in., the manufacturers of the machine state that it could all be removed in one cut. The production is 65 per hr. on each cut, or 33 finished pieces per hr., whereas if the amount of stock were reduced as sug-









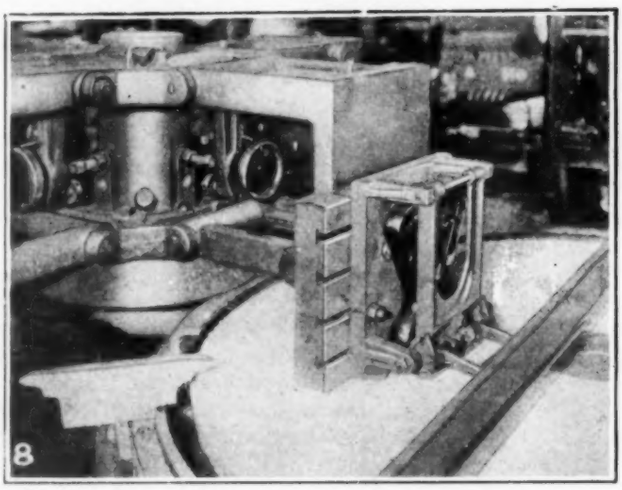


*Fig. 3—Cam-action fixtures for bearing caps. Fig. 4—Grinding ends of roller bearing cages parallel. Fig. 5—View in rear of machine. Fig. 6—Grinding ends of bronze bushings. Fig. 7—Automatically grinding piston ring faces. Fig. 8—Finishing bottom face of Toledo scale frame*

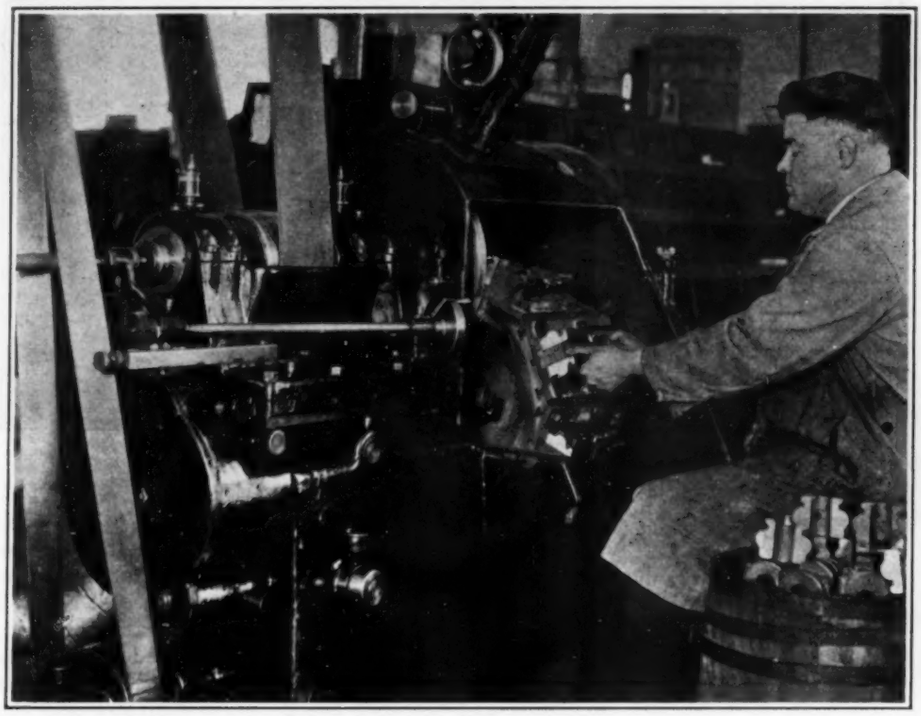


*Fig. 2—Finishing 600 bearing cap faces per hour*

gested, it would be easy to double the production.

The job of grinding 3¾x¼-in. piston rings on the No. 2 double disk grinder is shown in Fig. 7. The rings are stacked in a chute which is inclined slightly so that they will not jar off. An automatic plunger pushes a ring off the bottom of the stack at regular intervals, the ring falling into an incline, where it stands as shown in the illustration. The rings are held in position by a strap until the opening in the work-holder approaches, then a pusher plate bears on the side of the ring and pushes it into the opening of the plate and it is carried on in between the disk wheels. As the rings clear the wheels at the rear of the machine, they fall out into a receptacle. The work carrier shown in the illustration has ten holes, but the number of holes can be varied from six to twelve, according to the diameter of the work. The rings shown are of the Ford type and carry from 0.015 in. to 0.018 in. of stock each. The limit allowed for parallel is ±0.0005 in., and the thickness is held within 0.001 in. A production of 38 per min. is obtained.

The illustration, Fig. 8, shows how the Toledo Scale Co., Toledo, Ohio, finishes the bottom of its scale bases. The machine is a Gardner No. 24 Continuous Feed Disk Grinder, seen completed in Fig. 9. The machine carries a horizontal disk that is 53 in. in diameter, and is provided with a revolving reel that carries four vertical work tables. The work is held in fixtures that are attached to the tables, and as the reel revolves, each piece in turn is passed over the surface of the wheel. As soon as the piece is directly over the wheel, the table automatically lowers and brings the work to bear on the wheel, after which the table rises again as it leaves the wheel. In this way the surface of the piece is ground plane and a micrometer stop makes it possible to adjust the table so that the work will be ground to definite dimensions. A production of 90 per hr. is obtained, as compared with seven per hr. by the previous method.

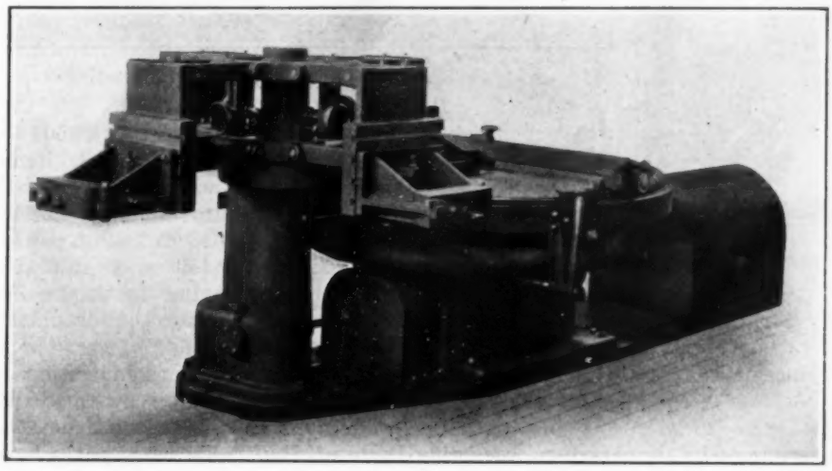


*Fig. 9—View of Gardner Continuous-Feed Disk Grinder*

## Determining the Relation between Two Hardness Values

In a recent issue of *Transactions of the American Society for Steel Treating*, Dr. G. K. Burgess, the society's president gives the following interesting opinion: "In our opinion, conversion tables for obtaining the Brinell hardness from the Rockwell hardness value or from the scleroscope value, should not be used. We have never attempted to make conversion tables of the kind, so we have no proof that it cannot be done, but we believe that the value should be reported as the hardness by the method which was used in determining it.

"It can be readily seen, that if for a given material there is a different relation between the Brinell hardness and the tensile strength and that later it has been found more convenient to use the Rockwell hardness tester and the conversion table to obtain the Brinell hardness from the Rockwell value, that serious errors may result. In our opinion, manufacturers can find the relation which exists between two hardness values for the particular material which they are using. This conversion factor should, however, not be used for other materials nor for materials of the same kind but of different chemical composition."

# Reclamation of Material by Welding

By William I. Morgan
Powell, Wyo.

On one of the large irrigation projects in this state the equipment consists largely of heavy excavating machinery that is operated to the limit of its capacity during the summer months. In order to limit expensive

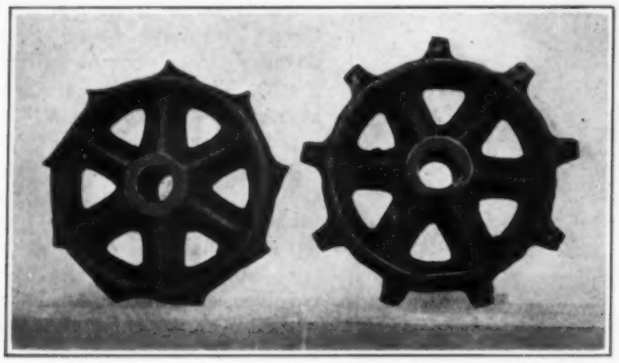


*Fig. 1—Sprockets reclaimed by building up teeth*

delays due to breakdowns, it is necessary to have on hand at all times a considerable quantity of repair parts, since it usually requires about a month to secure parts from the factory. During the winter this machinery is thoroughly overhauled and the quantity of material necessary to replace worn parts at this time is a very large item of expense.

About a year ago an electric arc welding outfit was purchased to aid in this repair work, and so much work was found for it that it has been operated day and night for several months. The scrapped parts had been piling up for several years, but they are rapidly being

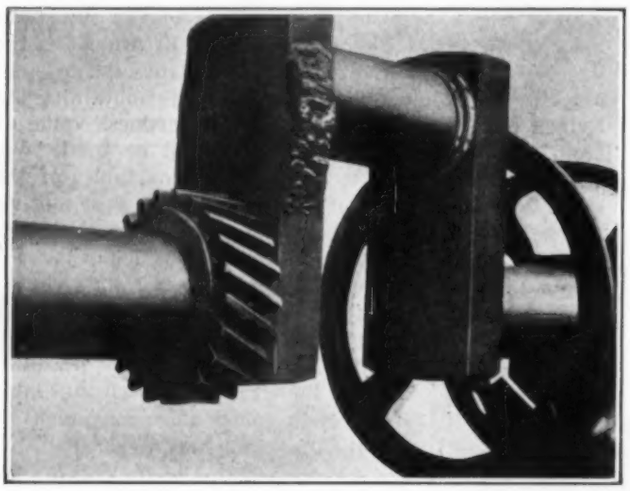


*Fig. 2—A broken crankshaft repaired by welding*

worked over and our purchases of repair parts are only a small percentage of what they were. In addition, a considerable portion of our stock of replacement parts has been transferred to other similar jobs.

The accompanying illustrations show some of the worn and broken parts which have been reclaimed by the use of the welding outfit. The cast-steel sprockets in Fig. 1 indicate how badly some of these parts are worn and how it was possible to build up the teeth. If new sprockets had been obtained from the factory the cost would have been $35 each, but the repairs cost only $6 for each sprocket, including labor, material and overhead.

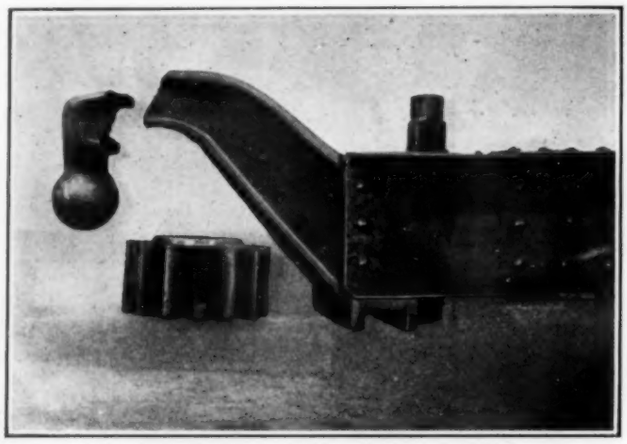


*Fig. 3—Broken casting repaired satisfactorily later*

A welded crankshaft from a 4-cylinder, 7x10-in. heavy-duty, marine engine is shown in Fig. 2. The crankpins and bearings are 2½ in. in diameter and the over-all length of the part is 6 feet. It would have taken six weeks and cost $375 to get a new shaft from the factory, but the total cost of the repair as shown did not exceed $40. This shaft has been in severe service for several months since it was welded.

The broken casting in Fig. 3 was repaired by welding without removing it from the 12-in. channels between

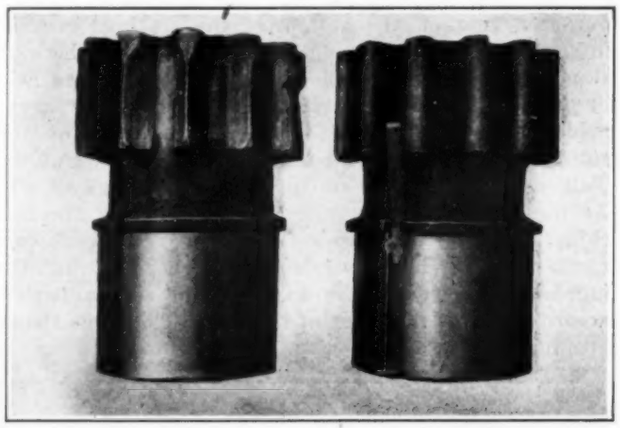


*Fig. 4—An example of pinion tooth repairs*

which it is riveted. The weight of the casting is 504 lb. and a new casting costs about $100. The cost items for the repair of this heavy part included 4 hrs. labor for preparation and handling; 5½ hrs. welding; 12½ lb. of material at 10 cents per lb., and 13.75 kw. of power. The total cost of the repair was $14.60, a considerable saving without considering the saving in production time of the machine or the extra labor that would be required to install a new part.

The pinions shown in Fig. 4 are a good indication of what has been accomplished in building up the teeth on such parts. New pinions cost $81 each from the factory, including bushings, but badly worn parts have been repaired in this manner at a cost of $11.50 each.

*Fig. 1—The Fiat Lingotto automobile plant*

# The Impressive Story of Fiat

**By J. A. Lucas and F. E. Bardrof**

A description of the Lingotto automobile plant—All fabrication of automobile parts now in one building — Shop arrangement and management — Apprenticeship system

PRIOR to 1919 the manufacture of the Fiat automobiles was being carried on in a number of plants located in different parts of the city of Turin. Each of these various establishments manufactured certain parts and each factory was subdivided on the machine tool classification plan. In other words, there were drilling departments and milling departments, planing and gear cutting departments, and so on. The entire arrangement of plants and departments was exceedingly inefficient from the standpoint of handling material, and the cost of transporting material and work in process, from plant to plant and from department to department, was nearly equal to the labor and material cost of the parts themselves.

In 1919 the situation was taken in hand by the engineers of the company and a close study and analysis of the conditions undertaken. The result of this research is the Lingotto plant, planned and built by Fiat for its automobile production. The planning of this great plant was a rather stupendous undertaking, when the conditions in Italy at that time are considered, and its successful operation speaks well for the foresightedness and clear vision of its builders.

*Fig. 2—The side of the main building*

Before going further into the operation of the plant, let us take a look at the building itself. It is composed of two main sections connected by five transverse sections that form four inner courts. The arrangement is clearly shown in Fig. 1. The length of the building is about 1,650 ft. and the over-all width is 260 ft. The main sections are five stories in height, the transverse sections being higher. Fig. 2 shows one side.

The arrangement of the inner courts and the connecting sections between the main wings is shown in Fig. 3. This view also shows the driveways that connect all the courts for the transportation of materials to the elevators

This is the fourth article of the Fiat series. The third article was concluded on page 696, Vol. 60, No. 19.

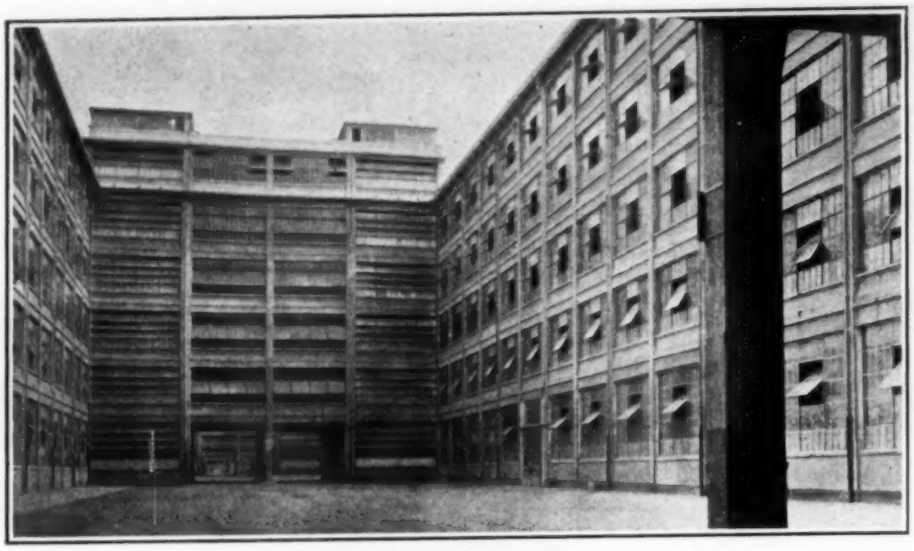


*Fig. 3—Transverse sections and inner courts*

located in the transverse portions of the building. It will be noted that the structure is of modern reinforced concrete construction with steel sash and other up-to-date features.

The general movement of the material in process is upward, and the finished car is finally delivered at the test track on the roof, shown in Fig. 4. This track is nearly three-quarters of a mile long and is built for high-speed tests. The tests that the cars undergo on this track will be considered later.

Directly south of the main building, that is, at the right-hand end in Fig. 1, is located another concrete structure, 660 ft. long by 310 ft. wide, which houses the stamping and forging departments. In front of this building is an open stock yard to which the billets and bars are brought from the Fiat steel mills. On the opposite side of the stock yard is located another building where the stock is drawn to size for working, sawed, and stored.

When the automotive production work of Fiat was reorganized in 1919, the parts of the car were grouped in a series of units, and a completely equipped shop for the manufacture of each unit was established in the new Lingotto plant. In the equipping of these unit shops, the necessary machines and tools for the production of the unit were taken from the old shops, and installed so that the material in process would flow in a continuous stream from machine to machine through the new shop. The effect of this arrangement upon the handling costs has, of course, been very great, because the disadvantages of widely-separated establishments and the awkward grouping of machines by kind were immediately eliminated.

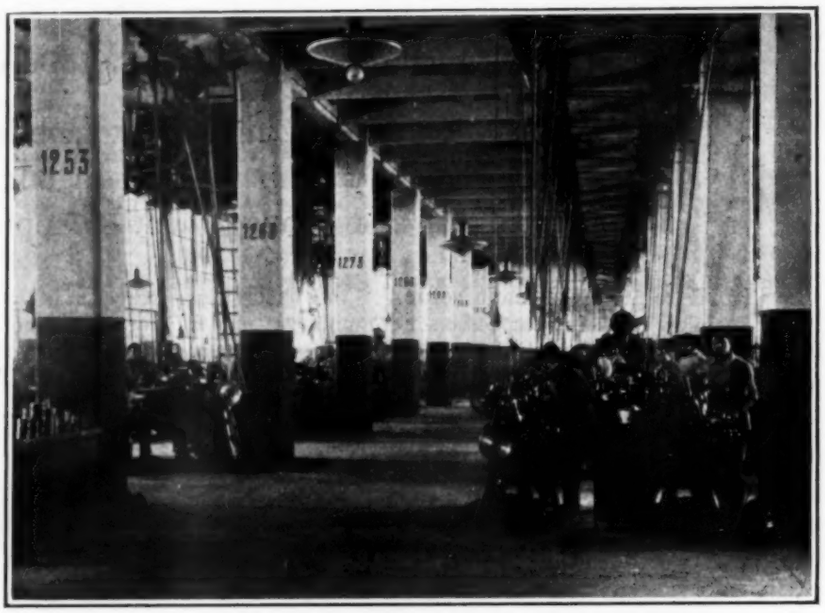



*Fig. 5—Location numbers inside the shop*

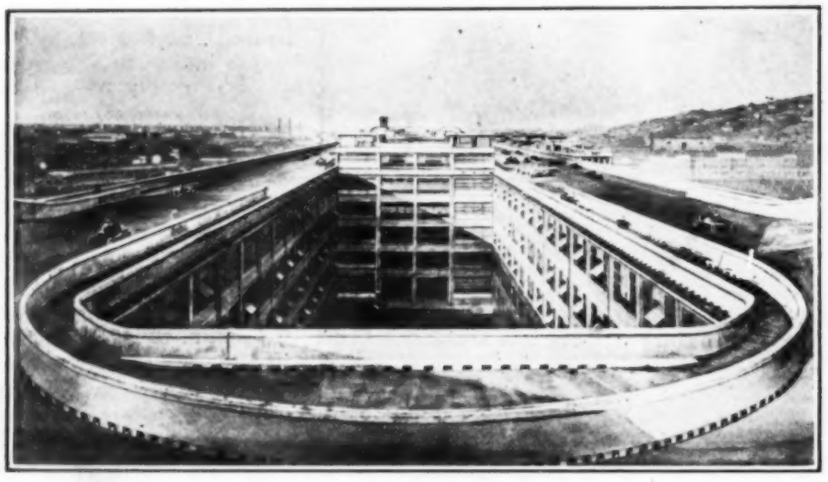


*Fig. 4—The testing track on the roof*

The units into which the Fiat car is separated for manufacturing purposes are (1) motor, (2) chassis, (3) rear axle, (4) front axle, (5) carburetor, (6) generator, (7) transmission, (8) steering unit, (9) wiring and dash, (10) body, (11) radiator. The Lingotto plant is in effect, therefore, a group of eleven independent shops, housed in the same building but entirely separate in operation and direct management. In fact, each department, as these shops are called, is entirely closed from the others, and the workmen and foremen from one

*Fig. 6—General manager's office*

system seems somewhat complicated to the uninitiated, but has worked exceedingly well in expediting material handling, service and supervision.

The wide aisle left in the center of each of longitudinal sections of the building for the handling of material and work in process is also shown in Fig. 5, and the modern construction of the building can be noted. A battery of the well-known Hendey lathes can also be seen in the right foreground of the picture.

The executive offices of the company are at present temporarily located on the first floor of the building together with the drafting rooms and engineering offices. A new administration and service building is in process of erection, however, and will house in a four-story structure the chemical and metallurgical laboratories in addition to the offices.

The office of the general manager of the Lingotto plant is pictured in Fig. 6 and, at the right-hand desk, we see the man who planned and built, and now guides all of its operations—M. Gobbato. A number of framed production charts are hung conveniently about the office and, by means of these charts, a complete control of all the operations throughout the plant is possible. There is a chart for each department, and each chart is posted by clerks each morning, so that it is an up-to-date picture of the progress of work in the department it represents.

The main engineering office is shown in Fig. 7. In this room all original and improvement designs for the various parts of

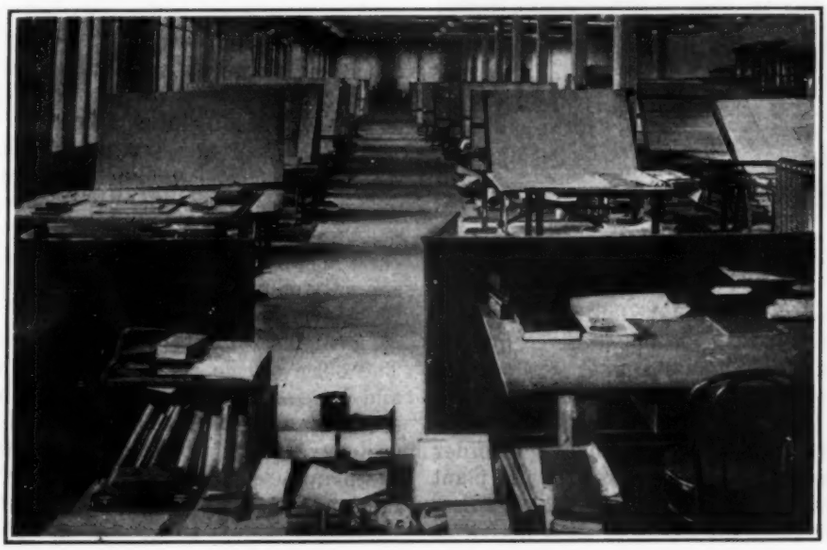


*Fig. 7—Engineering department*

department are not even allowed in another. Each department has its own tool room, testing department and assembly room, and furnishes its unit of the car ready for immediate assembly.

In Fig. 5 is shown the system of numbering by which the various parts of the shop are indicated, so that they can be quickly and accurately specified. For instance, the point of delivery of a new part for the grinding machine located near the column numbered 1263, would be completeley specified by this number, and a trucker is enabled to go immediately to any point of the immense building if the designation number of the point is given. Likewise, the showing of the number 1263 on the signal box in the doctor's office tells him that he is needed at this particular point, and he is enabled to attend an injured man without delay.

Each digit of the number has significance. The first digit designates the floor, the second and third the number of the column, and the fourth the number of the row in which the column is located. The rows are numbered from left to right looking south, and the columns are numbered from north to south in the rows. Other parts of the building and surroundings are also numbered. The transverse sections are lettered from north to south; the yards are classified by Roman numerals from north to south; stairways are shown by the transverse letter and figures indicating the left- or right-hand stairways looking south; elevators have the transverse letter and position numbers. The

*Fig. 8—Tool design and drafting room*

*Fig. 9—Employees' insignia*

the Fiat cars are made. The tool designing and drafting room is illustrated in Fig. 8, and is given over to the design of special tools and machines for production purposes.

We have already mentioned the fact that employees of one department are not allowed in others. In order that this rule can be enforced all persons in the plant wear insignia that indicate their rank in the organization and, at the same time, the limits of their activities in the building. The button *A*, Fig. 9, is worn by the higher executives of the company and this plant, and

*Fig. 10—The apprentice school*

serves as an admittance card to any part of the establishment at any time. A person wearing this button can go through the Lingotto plant from top to bottom without hindrance, but it is a privilege, of course, that comparatively few enjoy.

The department superintendents wear the button shown at *B*, and the wearer of this button finds himself somewhat restricted in his movements. The insignia at *C* and *D* are worn by the foremen and workmen, respectively, and admit the wearer only to the department in which he works. The discipline throughout the plant is almost as rigorous as that in a military organization. Orders are short but definite, and their execution is expected and obtained without comment from the lesser executives and the workmen.

### Responsible and Well-Trained Workers

It becomes at once apparent to the visitor that the workers seem much interested in their work, and that there is in this shop an air of concentration on the work in hand, and a sense of responsibility for the quantity and quality of the work produced. The mechanics are paid a fixed salary upon completion of apprenticeship and may, in addition, earn a bonus. This bonus is the difference between the earnings on a piece-rate basis and the fixed salary. On this basis the wages vary from 60 cents to $1.25 per day, according to the ability of the worker, but the purchasing power of this wage is not inconsiderable, for the prices of necessities are very reasonable and they are handled through the company stores at absolute cost.

A hospital room is located on each floor at the Lingotto plant with a nurse in attendance. Each of these rooms is equipped with an operating table and surgical instruments and is ready for any emergency. The office of the company doctor is on the first floor and he can be called in a short space of time to the scene of an accident by means of the electric signal system previously mentioned. At intervals throughout the plant are placed warming pans for the workmen's lunches and at these places a plentiful supply of cold running water is also supplied. This water is not for drinking purposes, however, but for keeping cool the red wine with which each workman keeps himself supplied and which is considered essential for keeping his digestive system in order and to build up his strength. A squad of uniformed firemen continually patrol all sections of the plant.

The majority of all the mechanics employed at Fiat are trained in the apprenticeship courses of the company. The sons and relatives of the workers receive first consideration when apprentices are employed, and others are taken in only when there are none of these on the list of applicants. The boy undergoes training for six months and is then given a test to determine his fitness for further work. Failure to pass this test means immediate expulsion, the test consisting of simple problems in mathematics and benchwork tests.

In one of the benchwork tests, a hexagonal nut is drilled, chipped and filed from a piece of round stock. The finished nut must be accurate and is checked carefully by the instructor. If the boy passes the test, he is allowed to proceed, and receives three years of instruction and practical experience in all departments of the plant. The result is that Fiat has a corps of intelligent, well-trained workers, most of whom are

able to perform the operations required in any part of the plant. In short, they are all-around mechanics. A view taken in the apprentice school is given in Fig. 10, and shows some of the boys working at the bench.

Promotions to the higher positions of the organization are always made from the rank and file, and in this way the workman is inspired to continue his studies at the conclusion of his apprenticeship. He is assigned to the department in which the work for which he appears to be best fitted is done, or to the department that he selects, in some cases.

A house organ dealing with the problems and difficulties arising in the manufacture of the product, and the methods of solution, reaches every worker in the Fiat organization. This monthly magazine also carries in its pages much practical material on higher shop mathematics and other related subjects. The executive staff, including chief draftsmen, designing engineers and purchasing agents, are all trained by the company to read and write English and among this group the *American Machinist* is freely circulated and intelligently read. Fiat executives are anxious to keep in touch with American methods and conditions.

Our next article will deal with the handling of the raw material at this great plant.

## Left-Handed Lathes in Italy

The middle illustration on page 606 has evoked considerable comment since it shows a line of Hendey lathes in the Fiat automobile plant that are apparently built especially for left-handed operators. We might make a dissertation about the unexampled efficiency of an organization that segregates all its left-handed lathe operators in one department and provides them with special machines suited to their physical peculiarities, but unfortunately such is not the case. The photograph was printed from the wrong side of the negative and an oversight allowed it to be published in that way.

While making the hundreds of photographs at the Fiat plant last summer, Mr. Lucas exhausted the stocks of films in the vicinity of Turin and enlisted the services of a photo-engraving company. This company sent wet plates to Mr. Lucas at the plant, and after exposure, they were returned to the engraver for development and printing. In handling the negative in the usual way the engraver, of course, reversed the picture as if for a halftone cut. The photograph of the Hendey lathes on page 606 was made in this way and was inadvertently published without reversal.

The job of foreman should not be that of a buffer, taking the blows from both the management and the men. It should rather be that of representative or interpreter of both sides. He should be able to explain the policies and actions of the management to the men and those of the men to the management.

The first requisite of a good foreman who is to retain his self respect is loyalty— to his *job*. If the men insist on acting unfairly to the management, he must notify them that loyalty to his job compels him to side with the management. If the management refuses to act fairly toward the men, loyalty to the job demands that he look for employment elsewhere. He should not feel obliged to uphold unfair tactics, but when he finds he cannot be loyal to the management he should lose no time in getting out.

## Stub Tooth Proportions

There are at least nine stub tooth systems now in use on this Continent where one would appear sufficient. As a result of the unanimous agreement of the members of the Tooth Form Committee, the American Gear Manufacturers Association propose for adoption as recommended practice, a stub tooth of the following proportions:

STUB TOOTH STANDARD

1. The use of both diametral and circular pitches.
2. A pressure angle of 20 degrees.

| | Diametral Pitch | Circular Pitch |
|---|---|---|
| 3. Addendum | $\frac{0.8 \text{ in.}}{\text{D.P.}}$ | 0.2546 in. x C.P. |
| 4. Dedendum | $\frac{1 \text{ in.}}{\text{D.P.}}$ | 0.3183 in. x C.P. |
| 5. Working depth | $\frac{1.6 \text{ in.}}{\text{D.P.}}$ | 0.5092 in. x C.P. |
| 6. Total depth | $\frac{1.8 \text{ in.}}{\text{D.P.}}$ | 0.5729 in. x C.P. |
| 7. Pitch diameter | $\frac{N}{\text{D.P.}}$ | 0.3183 in. x N. |
| 8. Outside diameter | $\frac{N + 1.6 \text{ in.}}{\text{D.P.}}$ | P.D. + (2 x Addendum) |

The above proportions are identical with those of the recommended practice for herringbone gears.

A minimum clearance of 0.2/D.P. is recommended for new cutters and gears. There is correct tooth action, however, between gears cut to this new system and those cut to the older Nuttall system, the only dimension affected being the clearance. Where the proposed gear runs with the Nuttall there is a clearance of 0.1425/D.P., and where the Nuttall gear runs with the proposed gear the clearance is 0.2146/D.P.

The full depth tooth is regarded by many, as of more importance than the stub tooth. The committee therefore wishes the Association to clear the table for new work, by formally adopting as standard practice, the following full depth tooth proportions, which are now in universal use, leaving to the future the debatable proportions:

STANDARD FULL DEPTH TOOTH

1. The use of both diametral and circular pitches.

| | Diametral Pitch | Circular Pitch |
|---|---|---|
| 2. Addendum | $\frac{1 \text{ in.}}{\text{D.P.}}$ | 0.3183 in. x C.P. |
| 3. Dedendum | $\frac{1.157 \text{ in.}}{\text{D.P.}}$ | 0.3683 in. x C.P. |
| 4. Working depth | $\frac{2 \text{ in.}}{\text{D.P.}}$ | 0.6366 in. x C.P. |
| 5. Total depth | $\frac{2.157 \text{ in.}}{\text{D.P.}}$ | 0.6866 in. x C.P. |
| 6. Pitch diameter | $\frac{N}{\text{D.P.}}$ | 0.3183 in. x N. |
| 7. Outside diameter | $\frac{N + 2}{\text{D.P.}}$ | 0.3183 in. x (N + 2) |

Committee report presented at the Annual Meeting of the American Gear Manufacturers Association, Buffalo, N. Y., April 28-30, 1924.

# Mounting Locomotive, Tender and Car Wheels

IN MOUNTING wheels on their axles it is highly important that the wheels be properly spaced with regard to the flanges, so as to allow the proper side play in running on the rails. The first step is to locate the center of the axle, as in Fig. 1, using the tram shown. A hook or lip is at one end of the tram and

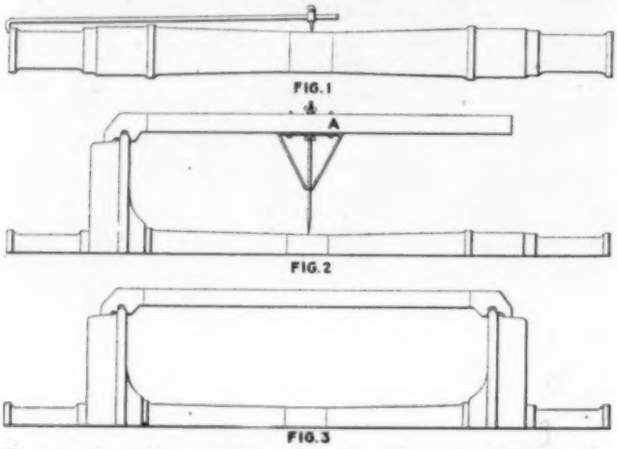



*Fig. 1—Locating center of axle. Fig. 2—Spacing the first wheel. Fig. 3—Checking spacing of both wheels*

an adjustable tram point at the other. Using the tram from both ends locates the center.

Having the center marked before the wheels are mounted, enables the use of the gage shown at *A*, Fig. 2. The central rod is adjustable for length to accommodate wheels of varying diameter, and is set for the

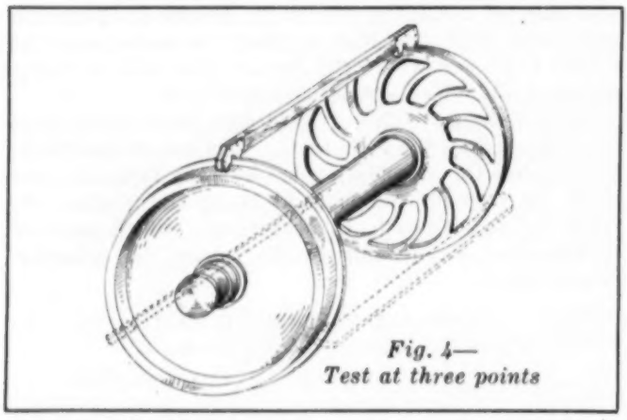


*Fig. 4—Test at three points*

desired wheel-diameter before using. The gage tests the location of the wheel flanges with regard to the center and shows whether both sides of the flange are properly located. There is also shown the method of spacing the first wheel, from the central point. In using this gage it is necessary to see that the gaging points bear on each side of the flange, when the point is at the center.

After the second wheel has been pressed on, the distance between flanges is gaged as shown in Fig. 3. The same precaution is necessary here regarding the bearing on each side of the flanges as in using the first gage. In testing both wheels, the gage should be tried at three equi-distance points around them as in Fig. 4, to test their squareness with the axle. For, although it might be possible to mount two wheels with the holes out of square so as to show flanges the same distance apart, such a condition is hardly likely to be met in actual practice.

In mounting wheels on axles, great care should be taken to keep the pressure between the minimum and maximum figures given in Tables I and II. For inter-

**Table I—Mounting Pressure for Engine Truck Axles**

| Diam. of Wheel Fit, In. | Pressure in Tons Wheel Centers Cast Iron | Steel |
|---|---|---|
| 3½ | 20–25 | 35– 42 |
| 4 | 25–30 | 42– 50 |
| 4½ | 30–35 | 50– 57 |
| 5 | 35–40 | 57– 65 |
| 5½ | 40–45 | 70– 72 |
| 6 | 45–50 | 72– 80 |
| 6½ | 50–55 | 80– 87 |
| 7 | 55–60 | 87– 95 |
| 7½ | 60–65 | 95–102 |
| 8 | 65–70 | 102–110 |
| 9½ | 80–85 | 126–134 |

**Table II—Mounting Pressure for Car and Tender Truck Axles**

| Diam. of Wheel Fit, In. | Pressure in Tons, Wheels Cast Iron | Steel or Steel Tired Tires on |
|---|---|---|
| 4 | 25–35 | 30–40 |
| 4½ | 30–40 | 40–50 |
| 5 | 35–45 | 45–55 |
| 5½ | 40–50 | 50–60 |
| 6 | 45–55 | 50–65 |
| 6½ | 50–60 | 55–70 |
| 7 | 55–65 | 60–75 |
| 7½ | ..... | 85–95 |

mediate diameters the next higher pressure is used. In all press fits, it is the practice to see that, for at least two-thirds the length of the wheel fit, the pressure shall be between the upper and lower limits given in the tables. This practice is to prevent the use of wheels where maximum pressure is obtained only upon the last third of the fit.

When the fit requires less than the minimum pressure for a third of its length, the wheel should be removed and another fitted which will give the required pressure. No wheels that may work loose should be permitted to go into service. In the case of driving wheels with tires on, the maximum pressures, or even 10 per cent more, may be used.

The above is from the methods in use in the various shops of the Santa Fé System.

# Pertinent Ideas on the Cutting of Threads—Discussion

BY T. S. GITHENS

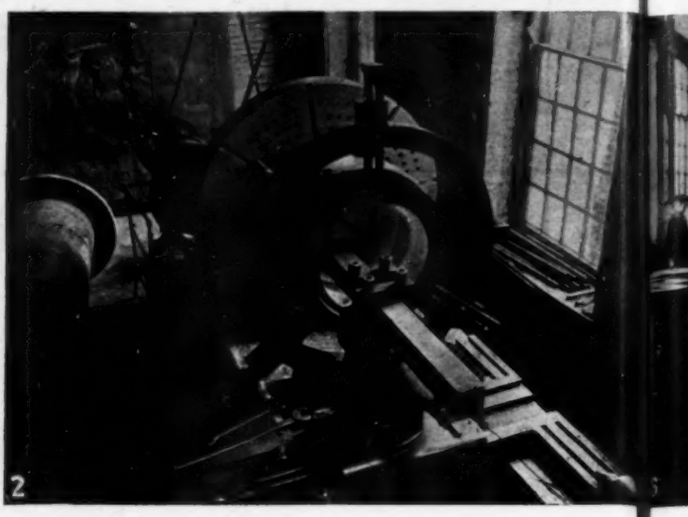
On page 573, Vol. 60, of the *American Machinist*, H. R. Fowler's article under the title given above, contains much truth in regard to the deficiencies of the average tap-drill list. There are, however, exceptions to this, among them being the ready reference charts of the Cleveland Twist Drill Co., and also some of the information that is in its latest catalog. There is also an article on Tap-Drill Sizes on page 194, Vol. 55, of the *American Machinist*, by Col. E. C. Peck and the writer, in which this matter was gone into in detail.

Mr. Fowler is not correct when he says that the conventional form of female thread-gage is nothing but a glorified nut with 100 per cent thread. The correct ring thread-gage has the same percentage of thread as the nut with the maximum minor diameter. The thread-gage will go on any screw that will take a correct nut.

# *Where Machine Tools Are Made*

**The Fosdick Machine Tool Co.**

Founded 1887



# *The Machine Shop Helps G*

## Each Water User Pays for Hi

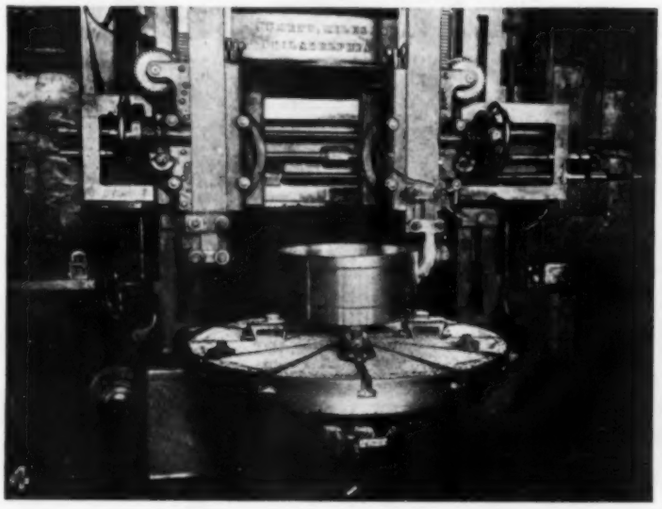
Fig. 1—Facing bosses on the "upstream" tube of a 48-in. meter

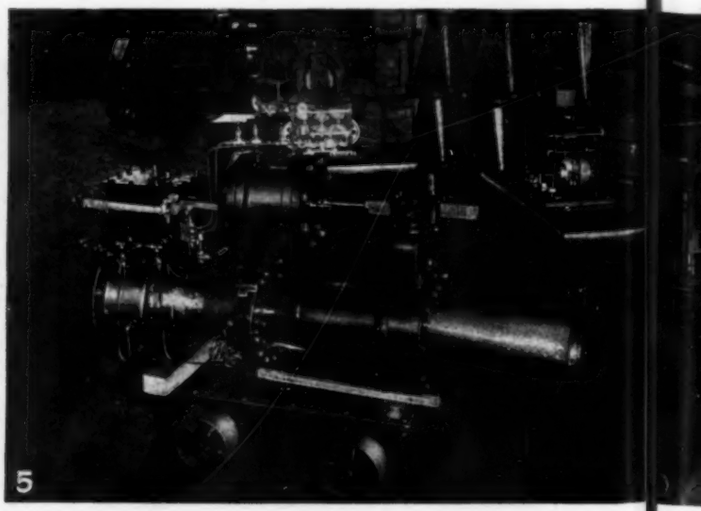
Fig. 2 —Boring the throat section for a 24-in. meter

Fig. 3—Testing a "downstream" tube at 650 lb. pressure

Fig. 4—Machining the brass liner for a 24-in. throat section

Fig. 5—Venturi meter that gives constant flow under a varying head





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## ps Guard the Water Supply

### for His Own Leaks and Waste

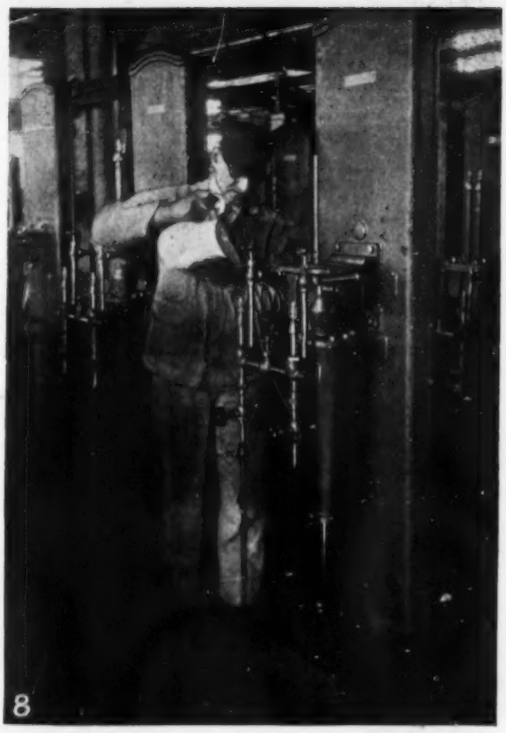

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Fig. 6—Work on meter tubes

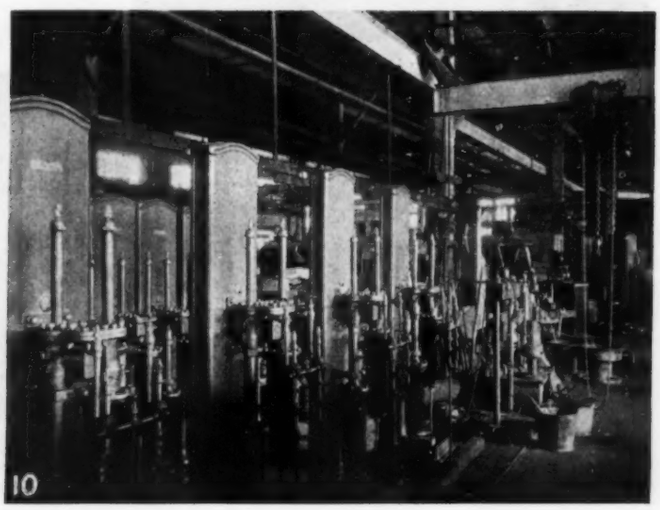
Fig. 7—Indicating mechanism in the repair department

Fig. 8—80 lb. of mercury is put into the chambers of the registering and recording instrument

Fig. 9—Assembling and adjusting the registering and recording instruments

Fig. 10—Rear of registering and recording instruments, showing mercury chambers and operating mechanism

Photographs by courtesy the Builders Iron Foundry



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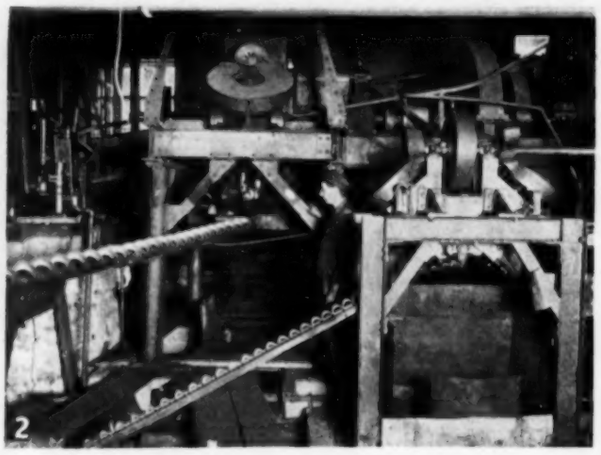
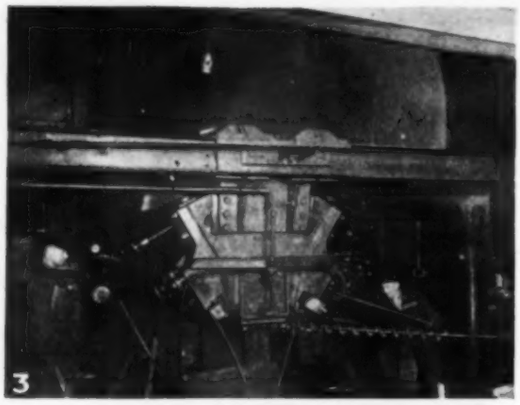
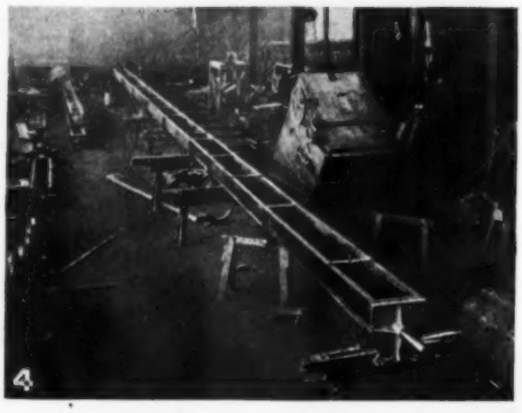






# *Helicoidal Conveyors in the Making*

Fig. 1—A portion of the raw material

Fig. 2—Cold-rolling flights for 2, 3 and 4-in. conveyors

Fig. 3—Hot-rolling flights for 4 to 8-in. conveyors

Fig. 4—Assembling conveyor in trough

Fig. 5—Hot-rolling machine for helicoidal flights from 9 to 16-in. diameter and ribbon flights up to 30 inches

Fig. 6—Assembling and riveting flights to make conveyors of any length

Photographs by Courtesy The H. W. Caldwell & Sons Co. (Link Belt Co., Owners)

# How to Estimate Machine Shop Costs

By Albert A. Dowd

## Classification for production estimates — Essential features of the machine tool builder's estimate—Estimates for contract and manufacturing work—Important records and preliminary operation sheet

PRODUCTION estimates are of three kinds. The first of these may be considered the sort made by a machine tool manufacturer who receives a request for his particular type of machine tool suitable for a given piece of work, the tools for which are to be furnished with the machine. The second is the sort used by a contracting shop fitted for the manufacture of different kinds of work in quantities. The third is the kind made up by a factory specializing on a certain kind of work and for use only in their own factory.

The machine tool builder's estimate is of somewhat different character from the other two, which are very similar. The machine tool builder designs his machine so that it will cover a certain range of work and, when

| EST. NO. | CUSTOMER | DATE REC'D. | REMARKS |
|---|---|---|---|
| 1764 | Phoenix Mfg. Co. | 8/20/22 | Bearing Cases |
| 1765 | Bartow Bros | 8/20/22 | Bracket |
| 1766 | Seeman and Rice | 8/22/22 | Pump Parts |
| 1767 | Alberg and Co. | 8/22/22 | Hand Levers |
| 1768 | Green and Brown | 8/22/22 | Hand Milling Machs. |
| 1769 | Foster Bros. | 8/24/22 | Spur Gears |
| 1770 | Brunelin and Joyce | 8/24/22 | Flywheel Repairs |
| 1771 | Norman Opsey | 8/26/22 | Improved Air Drill |
| 1772 | Scattergood Bros. | 8/27/22 | Special Machine |
| 1773 | Smith and North | 8/27/22 | Punches and Dies |
| 1774 | Wright Mfg. Co. | 8/28/22 | Thread Gages |
| 1775 | Orton Elevator Co. | 8/30/22 | Pump Cylinders |

*Fig. 8—Typical page from estimate record book*

he receives a request for a machine suitable for one or more pieces of work, he selects from his stock the best machine for the purpose, furnishing an estimate of the cost of the machine to his customer together with the cost of tool equipment, and the estimated production capacity. While in many cases the production is not specifically guaranteed, the manufacturer generally takes pride in providing a machine that will produce the work well within the time limit.

Manufacturers of all kinds of machine tools are called upon for estimates of this sort and, as competition among machine tool builders is keen, it follows that each of them is anxious to make as good an impression on the prospective buyer as possible. Hence, the cost of special equipment is kept down to a minimum, while the greatest care is taken to keep the productivity up to the maximum. In reality the machine tool builder is not, as a general thing, particularly anxious to make and sell special tool equipment, except as it assists in the sale of the machines themselves. He is, however, always anxious to have his machines show up favorably in comparison with others of the same type and, therefore, he makes the most of the production possibilities of his machine when rendering the estimate.

PHOENIX MFG. CO. — EST. NO. 1764

BANKSVILLE, OHIO. — QUOTATION— 9/4-22.

NATURE OF WORK:— Malleable Iron Bearing case, 8" diam. to be turned, faced, bored, and reamed. Patterns will be furnished by Phoenix Mfg. Co. but castings are to be made by us.

QUANTITY REQUIRED:— 5,000 per month.
Total quantity wanted:— 30,000 pieces.

DELIVERIES TO START— Dec. 1st, 1922.

*Fig. 9—Estimate record card*

In contract work estimates the profit on the work is determined on a percentage basis in accordance with the labor-hours consumed and other allowances which have been carefully figured to cover contingencies of various kinds. For this reason, tool costs and any other items of expense connected with the work must be very carefully considered because there is no opportunity for the contract shop to make a profit on the sale of a machine as the manufacturer does.

In production estimating, when the estimates are only used in a factory devoted to the manufacture of a standard product, such as an automobile, a sewing machine or some other complete mechanism, the piecework prices are set from the time studies made by the estimating department and, therefore, the final selling price of the mechanism is dependent on the estimate.

We have now reached a point where a clear understanding should have been reached by the reader as to the differences between the various kinds of production estimates. Assuming that we are ready to take up the various steps, let us start at the beginning of the process at the time when, in a contract shop, a blue print arrives in the morning mail with the request for an estimate of production on a quantity of perhaps 30,000 pieces. The blue print, together with the request and any other information pertaining to the matter,

This is the fourth article. The third article was concluded on page 688, Vol. 60, No. 19.

is turned over to the estimating department and the estimating process starts.

If there is only one blue print to consider the chief estimator can easily glance over it and read the letters stating the requirements in a very few moments, so that he can determine without delay whether the work is suitable for the factory or not. If suitable, he initials it, and turns it over to a clerk who gives it a number and a date.

This practice of giving each estimate a number and a date is the most convenient way of keeping a record of estimates made. A book, preferably of the loose leaf type, should be prepared and ruled as shown in Fig. 8.

CUSTOMER Chesaw Mfg. Co. EST. NO. 1764
ADDRESS Bankville, Ohio DATE RECD. 8/22-22
NATURE OF WORK Bearing Case WANTED 8/30-22

| OPN. NO. | DESCRIPTION OF OPN. | MACHINE | REMARKS |
|---|---|---|---|
| 1 | Hold by inside in spec. jaws, - bore, ream, turn and face | Tur. Lathe | Spec. tools |
| 2 | Hold in jig and drill (6) flange holes | Drill press | Use jig and 6 spindle drill head - Look up one we used for Smith and Dunn job - perhaps it can be used |
| 3 | Cut Keyway | Broach Mach. | Plug and broach reqd. |
| | Note! We shall probably need another broaching machine if we land this order as present machines are already overloaded, - Make note to this effect on Summary Est. Sheet | | add. |

*Fig. 10—Chief estimator's rough draft of machine work*

The entries are usually written by hand for the sake of convenience, the numbers being arranged numerically at the left-hand side of the page with the customers' names in the next column. The date when the request was received by the estimating department is also given, and the "remarks" column may contain any information which seems necessary. The principal purpose of this book is to keep the estimate numbers so that there will be no chance of duplication, and it has been the writer's experience that there is less chance of error in using a book for the purpose than when a card index is employed.

There should also be an alphabetical cross index in which the name of the customer is entered, and this record is preferably kept on a 3x5-in. card, like that shown in Fig. 9. The name of the customer should be at the top of the card, and either at the left- or right-hand side, as preferred. The address of the customer, the estimate number and the date of the quotation should be placed at the top of the card in some convenient manner. The body of the card should contain all the information likely to be necesary for a ready reference, such as the nature of the work, the quantity required, and any data regarding patterns, castings or delivery dates, that may seem pertinent or desirable.

If contracts are continually being made with the same customers, it is advisable to make these cards as complete as possible in order to avoid the confusion of one estimate with another. The date when the order is received and any other matters of this kind can be placed on the reverse side of the card, if desired, but as a general thing it is not advisable to do much more than record the date of the order. The total amount of the estimate and the actual cost of the work may be placed on the card for purposes of comparison, but it is not always possible to obtain this information for a considerable time after the work has been finished, so that the records are frequently left incomplete on this account. All these matters are largely dependent on the requirements of the department and the quantity of work which is being handled.

Due to the fact that the average estimating department is more or less flexible in its nature, the process used also varies according to the quantity of work on hand and the ability of the various men employed in the department. For the purposes of this article, we shall assume that the department is large enough and important enough to be handled in an up-to-date manner. The first step in making an estimate under these conditions, would be a conference between the chief estimator and his assistants, and at this conference the blue prints of the various parts which are to be machined would be looked over and the operations roughly planned. For work of this kind the easy procedure is to scratch down on a sheet of ordinary paper, the sequence of operations as decided upon and, at the same time, make a note or two in regard to any tools or special devices needed. These loose scraps of paper are very likely to be lost and it is much better to use a form similar to that shown in Fig. 10. This form can be printed on cheap paper and punched at one edge for a ring binder, so that it is much less likely to be lost or misplaced than a scrap of paper

OPERATION LAYOUT SHEET — ESTIMATE NO. 1764
DATE STARTED 8/26-22 — COMPLETED 8/30-22
CUSTOMER Phoenix Mfg. Co. PART NO. B-680
ADDRESS Bankville, Ohio. NAME Bearing Case
MATERIAL Malleable Iron

| SETTING NUMBER | OPN. NO. | DESCRIPTION OF OPN. | MACH. SUITABLE | TOOLS AND GAGES NEEDED |
|---|---|---|---|---|
| 1 | 1 | Hold in 3 Jaw Chuck, | U. and S. | Spec. Jaws |
| | | spec. jaws - rough | #6 Tur | Boring bars |
| | | bore 2" hole and | Lathe | and facing |
| | | rough face hub | | tools for C.S. |
| | | and flange with | | |
| | | C.S. tools | | |
| | 2 | Finish bore hole | | Plug limit |
| | | and finish face | | & shoulder gages |
| | | hub and flange | | |
| | 3 | Ream 2" hole | | Floating reamed |
| | | | | holder - and |
| | | | | 2" adj. blade |
| | | | | reamer |
| 2 | 1 | Hold in jig and | 16" Drill | Drill Jig. |
| | | drill (6) flange | | Spec. drill head |
| | | holes | | |
| 3 | 1 | Hold on plug | Broaching | Plug arbor |
| | | arbor and cut | Machine | 1/4" Keyway |
| | | Keyway | | broach |
| | | | | Keyway gage |

THIS LAYOUT SUGGESTED BY H.R.S.

*Fig 11—Preliminary operation sheet*

would be. A group of capable men can go over a great many blue prints in the course of a day and lay out roughly the operations for each part, much as shown in this illustration.

It must be remembered that this is only a preliminary layout and that it is subject to change when making the more careful plan. However, men of experience usually come very close to the mark at the first trial, especially if they are thoroughly familiar with the shop equipment and the character of the machines available. When looking at a blue print, however, to determine a method for handling a part, the matter of location of the work in jigs and fixtures may appear good at first glance, while a more convenient sequence of operations may be found advisable later on. This may be due to the location of machines in the shop and the matter of transportation from one department to another, or for some other reason which does not appear in the preliminary conference on the work. It may be considered that the first rough draft of the operation layout, as shown in Fig. 10, is made as a general guide in the layout of operations, while various other points of importance are taken up when making the preliminary layout.

### Preliminary Operation Layout

In order to note the difference between the rough draft and the preliminary layout of operations, a comparison may be made between Figs. 10 and 11. The latter form is printed and ruled and is usually written by hand by the assistant estimators or one of the layout men. The dates of starting and completion are given at the top of the sheet, together with information regarding the customer's name, the part number, the name of the part, and the nature of the material of which it is made. Each operation and each setting of the work are specified separately, and the method of holding for each operation is given. The machine best suited to the work and one which is available is indicated in the proper column, such information being obtained from the machine data sheets. The tools and gages required are also roughly specified but not in detail, although this matter is dependent largely upon the organization and the amount of work passing through it. In some cases, however, it may be found advisable to have the layout men specify each tool required in detail, and even make rough sketches of them in order to assist the time study men and those who make the tool and gage estimate.

These matters are to a certain extent controlled by the ideas of the chief estimator and the number of men employed in the department. It may be argued that there is too much repetitive work involved when this method is used, but it will usually be found that the extra labor is profitable and that there is less likelihood of serious errors which might occur with a less thorough system. We are not considering an estimating department composed of one man who does all the work, but rather a large department so arranged as to produce a really careful and accurate estimate of the labor involved in the manufacture of a given piece of work, the tools required, and the cost of the material. In these days of close competition the factory which handles its estimates in the most painstaking manner, and which at the same time exercises the right kind of supervision of the work in process, will find the trouble taken fully repaid by the orders received and the profits resulting therefrom.

## Machine Tools and Labor Saving—Discussion

By George F. Johnson

I agree with Harry Senior when he says, on page 494, Vol. 60, of the *American Machinist*, that he "does not get the view-point" of F. P. Terry as expressed by the latter in an article published on page 363 of the same volume. That is exactly what is the matter, as I see it, and in my opinion both gentlemen are right from their respective points of view. They approach the subject from different angles and emphasize two separate aspects of a single phenomena.

I think Mr. Senior is minutely right when he claims the title of "labor saving" for the machine that turns out flywheels for automobile engines at the rate of one every three minutes and twelve seconds as compared with the lathe, that makes a skilled man hustle to complete one such wheel in five hours. He is right, I repeat, when only the *minutiae* of the comparative production rates of two machines on a given number of a certain part is considered.

But what I think Mr. Terry meant to emphasize, though perhaps he did not make his meaning sufficiently clear, is not so much the trivial detail of production as the larger economic aspect that must necessarily accompany any advance in the art of producing commodities. It is probably true that there has never been, nor, indeed, can ever be, such a thing as a "labor saving" machine when we consider the matter in this light.

To illustrate: let us consider what happens when there has been a decided "cost reduction" of a motor vehicle brought about by the introduction of more rapidly producing machinery. Immediately there is a larger number of customers demanding that particular vehicle, and consequently a much larger number of these vehicles to be built. The operator assigned to machining the flywheels on the new time-annihilating automatic has enough flywheels ahead of him to keep him busy for many times the difference between the three-minute-and-twelve-second and the five hour periods. He has just as much labor, or more, than he had before, and in addition there is the labor of his helper, the toolmaker, and the extra office clerk that Mr. Senior suggests.

Examples could be multiplied. A reading of the industrial history of the United States since the time when Eli Whitney "tinkered out" his cotton-gin should convince us. Were we to continue our logic in a straight line from this point our reasonings would bring us to some very interesting conclusions, for:

> "There are many things 'twixt Heaven and earth, Horatio, of which you in your simple philosophy have never dreamed."

and we might even agree in the end with a certain modern thinker that the purpose of living, with all our scramble for increased production, is but to

> "——see the world as beauty."

The combined shop and roundhouse of the Central of Georgia railway in Columbus, Ga., has an interesting sign over the tool room window. It isn't new but it's unusual and is well worth careful consideration. Here it is—not a bad combination:

SAFETY FIRST
STOP THE WASTE

# Suggestions on Inventions and Patents—Discussion

By James McIntosh

IN AN article by Roswell F. Hatch, under the title given above, published on page 503, Vol. 60, of the *American Machinist*, Mr. Hatch gave some pointers of value which the writer would like to supplement. Priority as to the original idea and its development is of prime importance, provided there is evidence to prove it. Mr. Hatch advocated the value of retaining every sketch. To qualify the sketches as evidence, the signature of the inventor and date are necessary, while those of witness should always follow. In fact it is a good policy to make a confident of no one unless he agrees to sign, and the fact that he sees prior dates, perhaps days ahead of his own, will be sufficient to convince him that even a delay in making an application for a patent will not justify him in doing what he may feel like trying.

A personal experience with a high priced patent attorney will illustrate my point and show how the value of data did frustrate an attempt to "Pirate" patentable features, even in the face of a duly signed and witnessed drawing sent to him along with a complete description and affidavit, signed March, 1910. The delay in filing and other reasons led to another affidavit being necessary in July, and on July 27, 1910, the records disclose it was duly filed.

Later the patent attorney advised me that another client had got in just a little ahead of me. He did not realize that an actual photograph showing an essential detail had been made, and that a record of pattern work of the first experimental engine proved priority sufficient to destroy his prior client's claims and oust him out of the Patent Office, while my patent was allowed in full. The records will also show that later an attempt was made to destroy my patent by permitting it to lapse, due to failure to amend it, and my inquiry at the Patent Office as to its status and the attorney's claim for a fee for amending it did not correspond, so his power of attorney was taken away.

### Aim of the Inventor Properly Submitted

The inventor should know what he aims to accomplish and even that should be submitted, duly signed, dated and witnessed and recorded in duplicate so that the evidence cannot be lost or stolen.

All signed sketches should be filed. If such a record can be produced and shows development, the evidence will have weight, providing there is none to combat it and no suspicion lies against it.

A sketch book or a book in which to paste every sketch, from the first crude idea to the final solution, is the most convincing proof of who is the inventor.

Perhaps a suggestion that it is not a good policy to use a logical design for a patent drawing is of value, as an illogical design may destroy an interest that an otherwise good design might arouse.

The patent claims are all-important and it is advisable to claim everything possible in the original application. You may not (usually don't) get all you claim, but you will not get any more than you claim and the Patent Office will allow.

In making claims, aim at the result desired rather than at the detail used to produce it. A basic claim may be had with a detail that is not patentable, while a patentable detail cannot be used to produce a basic result and avoid a basic claim.

United States Patent 1,113,456 includes two basic results. Claim 2—"A valve for admitting air to the passage in position to precede a charge of mixture and means for varying the quantity of air admitted." Claim 8—"An auxiliary device for delivering air to the inner end of the piston at the extreme end of the stroke of the piston." What both volumes of air do, cannot be accomplished by the use of any device other than the detail indicated, even a new patentable detail cannot be used for the purpose of delivering air where the inventor does and evade his claims.

Incidental results, as set up in the preamble and specification, need not be claimed, for they are evident. Again the use of claim 8 does not limit the use of air at atmospheric pressure, as stated, or by supercharge, but the use of an auxiliary port, delivering air when and where the inventor does would be in conflict with his claims.

## Benefiting by the Experience of Others

By J. A. Watson
Glasgow, Scotland

The benefit of the other fellow's experience has often been pointed out in the columns of the *American Machinist*, both editorially and otherwise.

A good example occurred the other day. A master bushing had to be removed from a blind hole—quite a simple matter when you know how.

After the workman had spent a couple of hours in trying to remove the bushing, without results, the incident happened to come under the notice of the writer, who is an old reader of (and sometime contributor to) the *American Machinist*.

Remembering the hydraulic method of extraction, which has been described many times, the hole was partly filled with lubricating oil, and a tight-fitting plug inserted. A few hammer blows on the plug removed the bushing, and, let us hope, another convert was made to the benefits to be derived from the *American Machinist*.

The moral of this little tale is: Read your trade journals and get the benefit of the other fellow's experience.

## Why Not Use Semi-Finished Nuts?

By H. H. Gregory

I am interested in the use of semi-finished cold pressed nuts rather than hot pressed nuts in locomotive repair work.

A few of the advantages in favor of cold pressed nuts are that they are more uniform in dimensions, are less susceptible to breakage, and require no facing on either side. Some people object on the ground of the higher cost of the cold pressed nuts but I am told that the difference is comparatively little after all the discounts are taken from the list. I am informed that the net price of 1⅛-in. hot pressed nuts is $9.05 per 100 lb. while cold pressed, semi-finished nuts of the same size are $9.72 per 100 lb., a difference of but 67 cents.

In view of the slight difference in cost and the many advantages of the semi-finished nuts, there seems to be no question as to which should be used.

# The Manufacture of Rubber-bond Grinding Wheels

By Ellsworth Sheldon
New England Editor, *American Machinist*

## Vulcanizing the wheels—Static test to determine the breaking strength—Methods of dressing the wheels —The running test—Wheels for various purposes

IN A PREVIOUS article we have seen how the raw rubber in the shape in which it is received at the wheel factory is put into condition to hold the grains of abrasive, how it is compounded with sulphur and other chemical ingredients in order to render it susceptible to the vulcanizing process that is to transform it from a plastic and somewhat sticky mass into a serviceable cutting tool, and how it is rolled and cut or pressed into shapes of wheels required. It now remains to follow the molded wheels to the vulcanizer and through the after processes of mounting, dressing and testing, until the finished product is ready to be shipped to the user.

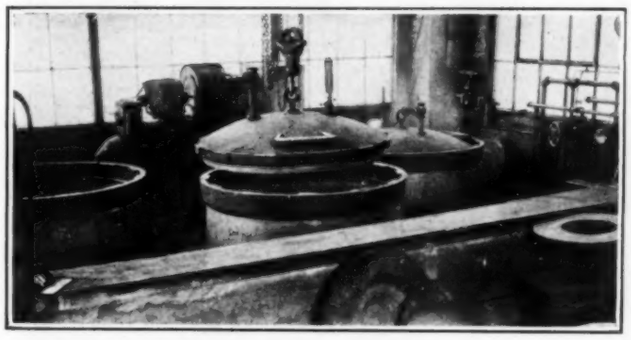


*Fig. 9—Tops of the vulcanizers; lowering a cover to place*

When a sufficient quantity of wheels has accumulated at the hydraulic molding presses or at the pneumatically operated "cookie-cutter" that cuts the thin wheels from the rolled sheet, they are stacked on iron plates to a height of two or three feet with thin metal disks between the wheels to prevent them from becoming welded togther in the vulcanizing chamber. Each stack is then bound together firmly by means of specially constructed clamps.

As the clamps are subjected to the heat of the vulcanizing chamber it is obvious that bolts two or three feet long, though under any amount of initial tension, would expand sufficiently under the influence of the heat to loosen their grip and allow the wheels to become warped. To counteract this tendency the clamps are designed to deliver their pressure through ingeniously constructed spring shackles containing heavy coil springs, so that the expansion of the bolts does not materially lessen the presure upon the stack of wheels.

For the thicker wheels sectional containers are provided which surround the wheels but do not interfere with the free circulation of steam and consequent transmission of heat. The containers do not take the place of the spring clamps, however, and two, three or four containers, according to the thickness of the wheels, are stacked between the upper and lower retaining plates as before and the stack bound together with the spring clamps.

The vulcanizing agent is steam, and the vulcanizing chambers are cylindrical receptacles, made of boiler-plate and sunk in the floor of the shop to bring the open ends to a convenient working height. Their depth is about six feet and the diameters range from 12 or 14 in. up to that necessary to accommodate the largest sizes of wheels. The upper ends of several of the chambers may be seen in Fig. 9 where one is shown open, another with the cover being lowered to place and a third with the cover on and locked.

The heavy cover of cast-iron is fitted to the open end of the receptacle with a shoulder for a gasket to prevent the escape of steam and is held in place by a series of lugs projecting radially from it and fitting into corresponding notches in a steel ring that is welded to the upper end of the boiler-plate shell. These lugs and notches form what is in effect an interrupted thread, and to fasten a cover securely it has only to be lowered to place on the gasket and given a partial turn

*Fig. 10—Lowering a stack of wheels into a vulcanizer*

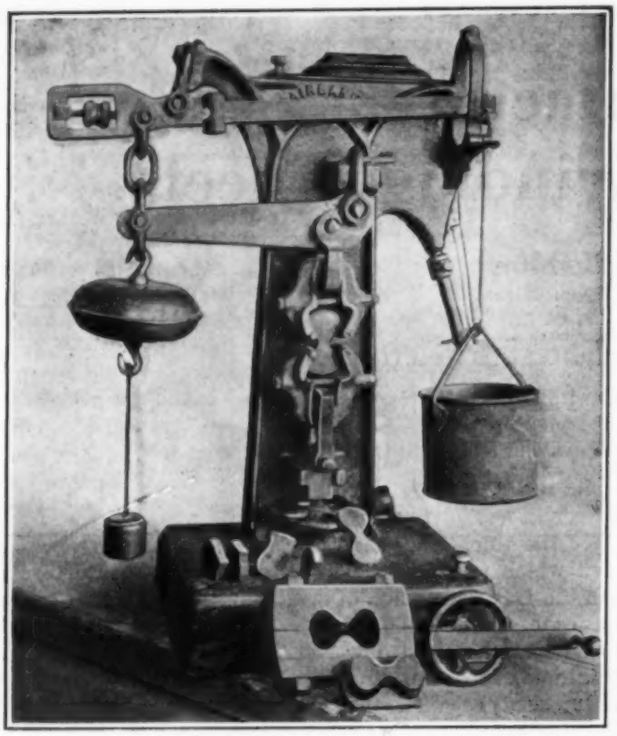


*Fig. 11—Machine for testing the strength of material*

by means of a pinion wrench, operating in the manner familiar to all mechanics who have used similar, though smaller, wrenches to tighten the well-known Jacobs or Almond drill chucks.

Steam is not generated in the containers, though there is no mechanical reason why it should not be if means were provided for applying heat to the bottom of the shell. It is much more convenient, however, to supply the pressure from an adjacent steam-boiler that is maintained for the purpose. When the cover has been lowered into place there remain no openings into the shell except the steam inlet and drainage pipes. A relief valve is provided in the cover, and each cover is also fitted with a thermometer the bulb of which projects into the chamber.

*Fig. 12—Pouring the soft metal bushings*

A stack of wheels may be seen in Fig. 10, bound by the confining clamps and being lowered into the chamber. When the chamber is filled with wheels, the cover is closed, live steam turned on from the boiler and the pressure allowed to rise to a point that corresponds to the required temperature. The vulcanizing temperatures range from 325 to 355 degrees of the Fahrenheit scale; the exact temperature at which a batch of wheels is vulcanized and the length of time the heat is applied, taken in conjunction with the chemical content of the prepared rubber, has much to do with the relative hardness of the wheels produced.

As the above factors exercise an important effect upon the structural strength of the wheel as well as its grade, it is necessary to keep a close check upon the results. For this purpose several blocks of the shape shown at the base of the machine in Fig. 11 are molded from each batch of material and are vulcanized with the wheels made from that batch. The blocks are then pulled apart by the testing machine and the result as shown by the scale is made a matter of record, so that the actual strength of any wheel may be definitely determined at any time.

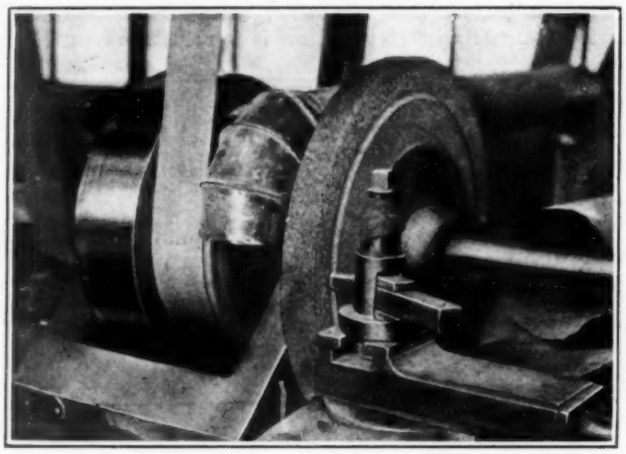


*Fig. 13—Facing the side of a wheel*

From the nature of the methods of production, all wheels being either pressed to shape in accurately made steel molds or cut with dies from calendered sheets of the abrasive stock, there remains very little to be done in the way of truing and dressing after the wheels come from the vulcanizers. Thin wheels that require no bushings may go directly to the testing department, or, if the diameter is a dimension of importance, they may be stacked upon an arbor that is provided with clamping collars and nut, placed in an ordinary cylindrical grinder and ground upon the periphery. Molded wheels are bushed with a mixture of lead and antimony, the operation being performed on the fixture shown in Fig. 12, which centers the wheel accurately over a stud of the same diameter as the nominal size of the center hole.

The diamond is used almost exclusively to do what little dressing and truing remains to be done. Fig. 13 shows a large wheel mounted on an arbor in a turning lathe while a facing cut is run over one side. The

*Fig. 14—Another method of dressing wheels*

operation as shown, however, is somewhat out of the ordinary, as a truing cut of this depth is seldom or never necessary upon regular work. Facing, as well as turning upon the periphery, is usually done upon machines of the type shown in Fig. 14; as by holding them in this manner the entire surface may be trued in one cut.

All molded wheels and the larger diameters of die-cut wheels are given an overspeed running test in the machine shown in Fig. 15, which is designed to enclose the wheel and prevent damage to surrounding objects or injury to operatives in the event of a bursting wheel. The marked excess of strength of rubber-bond wheels is well illustrated by comparison of the service and testing speeds with those of other classes of wheels. For clay and silicate bonded wheels a peripheral speed of 6,000 ft. per minute is usually accepted as the safe working limit and such wheels are tested at 10,000 feet. Peripheral speeds of 8,000 and 10,000 ft. per min. are commonly employed where rubber bond wheels are used,

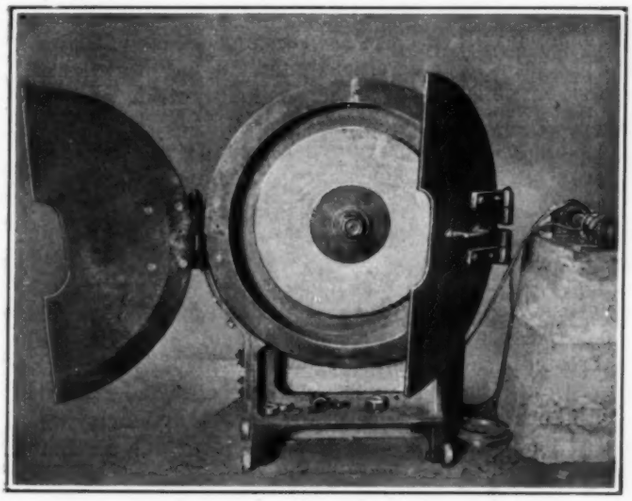


*Fig. 15—The running test; 20,000 ft. per minute*

and the testing speed is 20,000, or double that applied to the other wheels. As the radial stress increases as the square of the velocity it will be seen that rubber wheels are called upon to withstand a strain four times as great as that imposed upon clay-bonded wheels before they are allowed to go into stock.

Because of the ease with which the plastic rubber may be molded and the comparatively low heat necessary to accomplish the vulcanizing, rubber-bond wheels are well adapted to special forms, where it is necessary or desirable to have the wheel mounted upon some form of metallic center or spider. In Fig. 16 may be seen various examples of molded and cut wheels.

In the above illustration there is a thin disk of abrasive molded to the cast-iron plate of a standard Gardner type disk grinder. In this case the plate is drilled with a number of $\frac{3}{8}$-in. holes, generously coun-

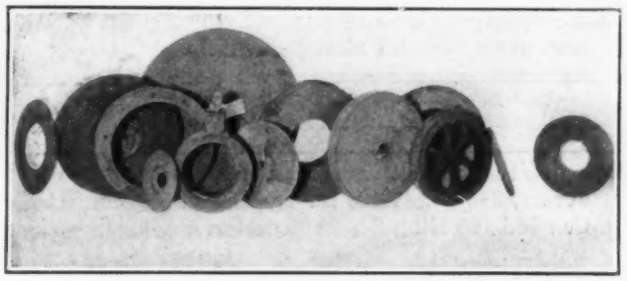


*Fig. 16—Various shapes of rubber-bond wheels*

tersunk on the back of the plate. A disk of the plastic abrasive is then laid on the plate, surrounded by a retaining ring, and the whole placed in a hydraulic press where it is subjected to a heavy pressure. The pressure causes the plastic material to flow into and fill the countersunk holes, thus forming a series of rivets or dowels composed of the abrasive material. The com-

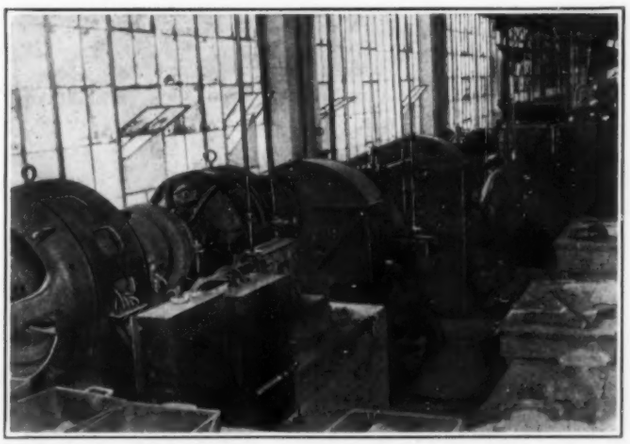


*Fig. 17—General view of a breaking-down mill*

posite disk then goes to the vulcanizing chamber and when the process is completed the abrasive ring can be removed from the iron only by breaking it in small pieces.

An alternative method, which involves a somewhat thicker wheel, is to mold suitable nuts into the abrasive disk so that the latter may be fastened to the cast-iron plate by ordinary machine screws. The nuts are first attached to a master-plate of iron and the plastic material molded and vulcanized over them in the man-

ner just described. When the vulcanizing is completed the abrasive disk may be removed from the master plate by withdrawing the screws and attached to the machine plate, which is previously drilled and countersunk to correspond to the holes in the master-plate.

A general view of one of the breaking-down, or "conditioning" mills in which the raw rubber is treated is shown in Fig. 17, with driving motor and speed reducing gear. The motor runs continuously at a speed of 600 r.p.m. and drives the mill shaft through a Poole annular reduction gear with a step-down ratio of ten to one. This speed is further reduced by the mill gearing to 17 r.p.m., which is the speed of the faster moving roll.

A magnetic clutch and brake is interposed between the motor and the reduction gear, operated by a touch upon the safety chain that is suspended over the mill rolls in such position that any involuntary movement of the operative in case of accident will trip the switch and shut down the mill almost instantly.

## *Book Reviews*

**Mechanical World Year Book. 1924.** Clothboard covers, 348 pages 4x6 in. Published by Emmott & Co., Ltd., 65 King St., Manchester, England. Price 1/6 net.

The 1924 edition of this justly popular little book is a worthy successor of its predecessors. A great variety of mechanical subjects are treated, including power plant equipment and operation, design of power transmission apparatus and machine shop and foundry practice.

Mathematical tables and tables of proportions of standard parts are included at the end of the text. All the material is given in a concise, well-arranged form and the book will be found to contain much valuable and accessible information for mechanical executives, designers and machinists.

**The Locomotive,** Published by the Hartford Steam Boiler Inspection and Insurance Co., Hartford, Conn. Cloth Boards. Two hundred and fifty-three 5¾ x 8¾ in. pages.

The 34th volume of this publication is assembled from the quarterly bulletins of the company for the years 1922 and 1923. It contains much data on the construction and use of steam boilers and accessories. A valuable feature is a list of all boiler and flywheel explosions that have occurred during the time covered, accompanied by many illustrations, descriptions and causes for such accidents. Such statistics and notations serve as horrible examples and tend to promote safety.

**Marks' Mechanical Engineers' Handbook. Second Edition.** Edited by Lionel S. Marks, Professor of Mechanical Engineering, Harvard University, and prepared by a staff of specialists; 1,986 pages; 4½x7 in.; flexible covers. Published by McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price $6.

The second edition of this well-known handbook follows the same lines as the first edition, and states the best engineering theory and practice as it stands at the beginning of 1924 in those branches of most interest to the mechanical engineer. The typographical and other errors incident to a first edition have been largely eliminated and revisions or additions have been made where necessary.

In most cases the revisions have been made by the original contributors, but in cases where the original contributor was not available the work has been done by other specialists. It has been found necessary to increase the size of the book by about 150 pages, in spite of the condensation and elimination of considerable portions of the original text. This increase has been made to accommodate new matter.

This edition will be found strictly up-to-date and authoritative in every particular and a worthy follower of the former edition which proved so popular among engineers.

**Hand Book of Practical Mechanics,** third edition. By Charles H. Saunders. Published by E. H. Saunders, 31 Bay State Road, Boston, Mass. Cloth boards. Two hundred and fifty-one 4¼ x 6¾ in. pages.

This book contains the usual tables and much of the data to be found in pocket books, some of the data being in condensed form.

As none of the pocket books for the same professions differ greatly as to character of contents, there is little that can be said in reviewing them, except to express wonder as to why so many of them are published.

While the book in question is compact, the typography is very poor, some of the matter being photographic reproductions of hand made tables and data.

## Steel Castings for Gears

At the fall meeting of the American Gear Manufacturers Association in 1923 a general specification for steel castings for gears was reported and the report accepted but as it had not been before the members for the necessary thirty days it could not be passed as a recommended practice.

This report provided for three grades of steel gears, case hardened, untreated and treated. To meet these three requirements two grades of steel castings were specified as follows:

For case hardened gears a steel of 0.15—0.25 per cent carbon.
For untreated gears a steel of 0.30—0.40 per cent carbon.
For treated gears the same steel, with 0.30—0.40 per cent carbon.

In all cases the phosphorus and sulphur limits of A.S.T.M. Class B castings are recommended, as follows: Phosphorus, acid process, maximum 0.06 per cent; basic process, maximum 0.05 per cent sulphur, either process, maximum 0.06 per cent.

In all cases the same manganese limits as for S.A.E. low carbon forging steels are recommended, namely 0.30 — 0.60 per cent. This specification replaces that adopted in 1921, but continues in force the annealing specification of 1922.

In submitting this recommendation your committee has considered that with the maximum manganese held to 0.06 per cent, a water quench could safely be used for treated gears and give the desired physical characteristics, without the need of using a special analysis with higher carbon for this purpose. A maximum carbon of 0.40 per cent and a cheap quenching medium we considered to be highly desirable.

Report of the Metallurgical Committee of the American Gear Manufacturers Association presented at Buffalo, April 28-30, 1924.

# Getting the Best Men in the Machine Business

**By John R. Godfrey**

Old man Johnson's son Tom tells him what ails the machinist trade and tells him how it can be made more attractive to boys

OLD MAN Johnson's boy, Tom, is coming along. He's got a bunch of horse sense besides his college education, and the combination is rare enough to be noticed. Likewise it's an asset to any man or company fortunate enough to possess it.

I happened in the office the other day just as Tom was having a confab with his Dad. And as he was chock full of notions about hiring and holding men, I'm passing a few of them along for the good of the craft. Getting enough boys of the right kind is becoming quite a problem in many shops.

"Dad," he said, "we're not getting as many boys, and young men, of the right kind, as we should. Perhaps you don't realize it as I do, but when I see good machinist material jerking soda water or punching an adding machine in a bank, it makes me peeved. We need 'em in the machine business and we're going to need them more as the years go by. It may be all right to *say* we don't need machinists with our modern machine tools, but we know better. We need real mechanics to make fixtures and special tools, and to keep our automatics and semi-automatics on the job."

"The boys now-a-days, Tom, don't want to get their hands dirty. They want white collar jobs even if they don't pay as much. When I think of how I learned the trade for 50 cents for a ten-hour day, this makes me sore!"

### Theatre Tickets Are Higher

"Getting sore doesn't help matters a bit, Dad. Forget the 50 cents a day too, while you're at it. You used to take your girl to the theatre and blow her to the best seat in the house for a dollar and a half for the two tickets. The same seats today cost one of our apprentices anywhere from five-fifty to eighty-eighty—and other things in proportion. We've got to face things as they are, not as they used to be or ought to be.

"It isn't because of any one thing that boys don't come into the shop these days. There are a dozen reasons as I figure it, and I've been looking into it a lot. It isn't getting your hands dirty, it's getting them clean enough to go to a dance with your best girl. And machinists like to dance as much as any one. It's keeping your clothes presentable. Then, too, there isn't as much prestige in being a machinist as there used to be. We know it ought not to make any difference but we know it does. A girl who has to choose between a machinist and a bond salesman, has a real problem if she cares anything about the social game.

"Then, too, the fond mother has a lot to do with the boys not going into the shop. And I don't blame her specially. All she knows about it is dirty hands and clothes, lack of social advantages and the danger of getting hurt. In the old days the women of the town knew much more about the small shops than women today can know about the big ones.

"But there are other reasons, Dad, a lot of 'em. When we get a good boy what do we do with him? True, we've raised the ante way up above your 50-cents-a-day schedule. We try to teach him all we can of the motor building game, for we've got a pretty good apprentice instructor. But we don't take as much personal interest in him as we should. And what do we offer him after he gets through this apprenticeship?"

"Tom, my boy, are you trying to tell me we don't pay wages enough or what? I don't get you—unless you've turned bolshevik, or something."

### Plasterers Are Well Paid

"Cut out the funny names, Dad. I'm trying to show you what ails the whole machine industry, not just our shop. We pay as much as the rest and we treat 'em square. But, unless a boy has a real love for the shop why should he work for us for seven dollars a day when he can get sixteen as a plasterer? We can't pay sixteen and I'm inclined to believe he's better off in the long run on the seven he gets here. But we haven't tried to show him why.

"We ask a boy to spend three or four years, after he leaves high school, to learn our business. And we pay him seven per after he gets through. But then we hire a hunkie who never saw a high school nor spent an hour learning a trade and put him on a turret or a semi-automatic, on piece work. And before we know it he's earning eight or nine dollars a day against the seven we pay the man we've trained.

"Our trained young man can set up any machine in the shop. He can build any fixture or make any tool we need. He can repair any breakdown and get production under way with the least delay. He is dependable in every way, and that is something that we haven't yet learned how to pay for. And its worth real money to know we can count on him in any emergency.

"In spite of all this, we can't see our way clear to pay him as much real money as we do the operator who can't do a darn thing except run one machine after our trained man sets it up for him."

"But our man soon gets to be a foreman Tom, don't forget that!"

"I haven't, Dad. But that's about all he does get. He annexes a lot of responsibility for mighty little extra money. I sometimes wonder if he wouldn't have more fun out of life as an operator, without a care in the world except quitting time and pay day. No, Dad, we've been kidding ourselves, we haven't made it financially or otherwise worth while for the real man who sticks by us through thick and thin, who keeps production coming through in spite of all sorts of difficulties.

"There's a lot of things must be done, Dad, to put the machine industry where it belongs. Not just the Johnson Motor Works but the whole machine building industry in this town and in every town. We've got to sell the machine industry to the town—got to make the town see that it's the greatest business in the world —a business they ought to be proud of. We've got to begin with the school teachers and the parents. The teachers must be made to see that without the machine industry we wouldn't have our modern comforts such as electric lights, vacuum cleaners and radio. We wouldn't have washing machines or automobiles, mowing machines or locomotives.

"There's a romance to building machinery that affects the comfort and welfare of the whole world and somebody must bring it home to the people of the town. We've got to show the boys, and their parents too, that the man who helps to build motors for automobiles, trucks, airplanes and boats is a much more valuable member of society than the man who gambles in real estate or stocks. The mechanic produces and adds to the wealth of the town. The other chap doesn't produce a darn thing but only helps to create fictitious values of things he doesn't produce at all.

### Keeping Up Interest in the Job

"We've got to get together and show people in general what we make and where it goes. It would add interest to every man's job if he knew just how important his work was to the finished motor—if he knew why his work had to be held within two-tenths while another piece was O.K. within two-thousandths.

"When an order goes to Hungary or Russia, tell the men about it and show them pictures of the motors in use over there. Every Hungarian and Russian in the shop would be more interested if he knew his work was going 'home.'

"It isn't alone the money that attracts a real man, either. The all around man might not feel so badly about the operator earning more money if there were other compensations. Suppose we give him a 'position' instead of a 'job'? Suppose we call him a 'master machinist' and put him on a weekly salary instead of paying him by the hour and ringing him up on a time clock? What about giving him a week's vacation with pay? A few privileges to show that we consider him of greater value to the shop than the mere operator, will go a long way toward making him happy and contented. He'll be more dependable than ever and we'll all be the gainers.

"There may be a few who will take advantage of such privileges. They can easily be dropped if they don't reform. But I'm sure that the rank and file of the kind of men we want will respond to something of this sort, if its genuine on our part. If we only go into it as a way to fool good men into staying and don't play the game ourselves, it will soon peter out. Insincere plans always do. You've told me that time and again. I'm sure, Dad, that I know our boys well enough to vouch for its working, if we do our share."

The old man hasn't kept still for such a long time in years. But Tom has a convincing way with him, and then, too, the old man is a bit proud of the way he has taken hold in the shop.

"What do you think of it, Godfrey?" he said to me.

"Sounds like his last name was Johnson," says I, "and it isn't half as impossible as some of the things I've heard you say, and get away with."

I'm betting that Tom will have a corps of the best young mechanics in town if he doesn't get side tracked.

# Motor Shop Problems

## *Broaching Round Holes*

By Frank C. Hudson

WHILE broaching is not a new art or process, it may be said to have cut its teeth on work in automobile shops. No pun intended. For the automobile power plant and driving mechanism afforded many opportunities, both as to suitable work and quantities, that made it profitable to invest in expensive broaches. Holes for splined shafts and round holes in connecting rods and many other parts lent themselves readily to the development of broaching.

Hailed as an economical method of machining odd-shaped holes, it has probably been used more for round holes than anything else. And here is where some of the problems are presenting themselves.

Take for example the broaching of bushings in the small ends of connecting rods, where they are used, the broaching or burnishing, or both, of the crankpin bearing end of the rod, or the broaching of push rod guides by the use of steel balls as burnishing tools.

If the ball or other burnishing tool is round to start with there is little doubt as to the hole being round after it goes through. Perhaps, "as it goes through" would be more correct. For the great trouble seems to be that the metal doesn't "stay put," but has a way of springing back after the ball or other tool passes. Of course, it isn't much, perhaps only a fraction of a thousandth, but enough to bother production in these days of accurate work and close tolerances.

### Elasticity of Metal and Thickness of Wall Affect Size of Broached Holes

Those who have studied the matter closely find that the cause of this change after broaching or burnishing depends largely on the amount and the distribtuion of the metal around the hole, as might be expected. If, for instance, the hole has an eighth-inch wall at one end and a half-inch wall at the other, the hole will be smaller at the thin end because the metal springs away from the broach and springs back after it passes.

If, on the other hand, the metal surrounding the hole has a reinforcing band at each end, the finished hole will be small in the center.

These observations refer largely to bronze bushings held in steel. And while some still finish such bushings by the broaching or burnishing method there is a feeling that the tendency of bushings to spring back after the tool passes, prevents this from being the best method. Grinding, reaming and single point boring seem to be having an inning just at present.

# Ideas from Practical Men

**Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for**

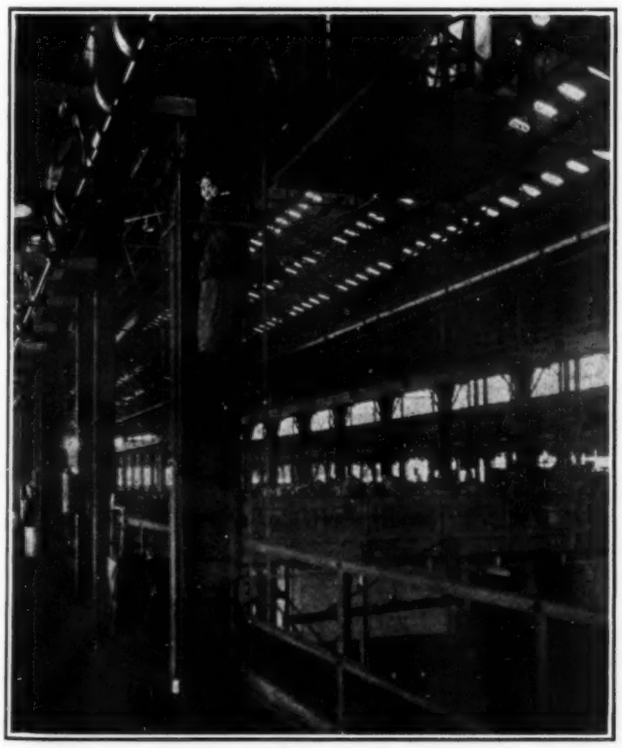
## Safe Crane Landings

BY ELLSWORTH SHELDON

In installing traveling cranes in factories too little attention is given to the safety and convenience of the operator in entering or leaving the control cage. In many cases a portable ladder is the only means he has of getting to and from the crane, and if somebody happens to borrow the ladder, the operator is forced to rely upon his own resources in getting out.

Sometimes a permanent ladder, consisting of iron rungs let into a brick sidewall or fastened to a steel column of the building, is employed. This ladder is usually unprotected and the operator, after climbing many feet from the floor, is compelled to turn about-face while clinging with one hand to a rung above him, and step across a considerable space to the floor of the cage. This is an apparently simple and easy thing to do—but let someone who is unaccustomed to dizzy heights and whirling machinery try it.

The Bullard Machine Tool Co. operates seven 20-ton traveling cranes in its main shop at Bridgeport; three upon one runway and four upon another. During the height of the wartime labor shortage, this company was compelled to put young women in charge of its cranes, and so expert did these girls become in their operation that their employer would not now consider displacing them in favor of male operators.



*A safe landing for a crane*

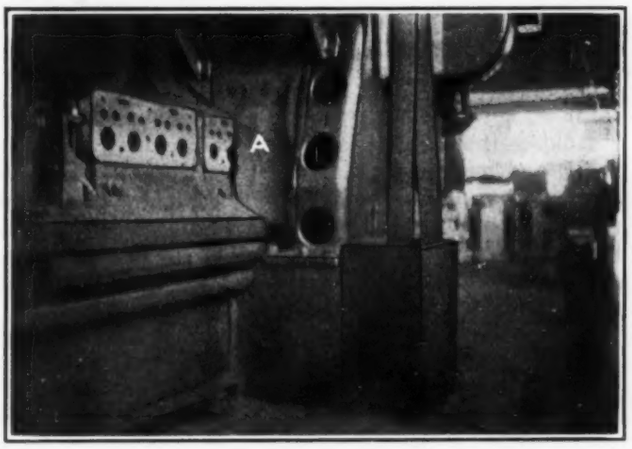
To safeguard the operators in entering or leaving the cages, a wire-enclosed platform, level with the floor of the cage, is built out from a column of the building far enough so that there is a clearance of but an inch or two between it and the crane cage. To get out of her perch, the operator has only to bring her crane to a standstill with the gateway of the cage opposite to the platform (there is a separate landing for each crane) walk across a perfectly level flooring in which there are no breaks, and descend the enclosed ladder.

The wire enclosure surrounding the ladder is just large enough to permit freedom of movement while on the ladder but still sufficiently confined to render a fall a practical impossibility. It extends to within about four feet of the gallery floor, and not for an instant after leaving the cage is the operator free from the protecting network of ladder or platform until she is on the floor.

## A Simple Chip Guard

BY CHESTER H. FRANKLIN

I saw a chip guard on a large Ingersoll milling machine not long ago that was unusual, in spite of its being extremely simple. It was merely a piece of heavy burlap as at *A*, fastened to the cross-rail of the milling machine and having an opening cut so as to fit around the string of cylinder blocks, allowing them to pass through as they were fed to the milling cutters.



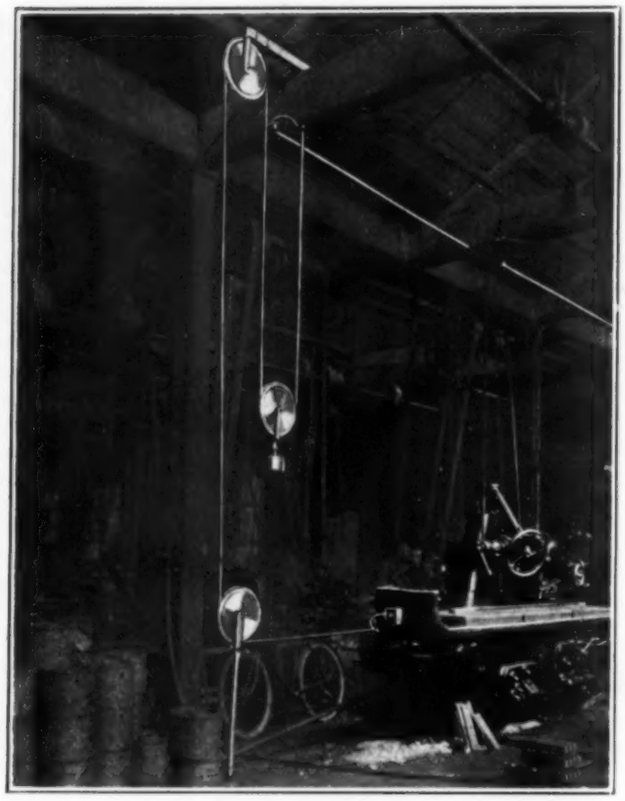

*A simple chip guard*

This device effectually prevented the chips from flying, and made it easier to keep the floor clean around the machine, as well as reducing the time required to clean the fixtures before loading for the next string of blocks.

## Keeping the Electric Cord Off the Floor

By Jack Williams

Though the magnetic chuck as a complementary part of regular toolroom equipment is thirty years old, and though necessity promptly eliminated—or, rather, forestalled—the use of the loose double-conductor cord for transmitting the energizing current from generator or junction box to chuck in the case of grinding machines with rotary tables, that same cord is still flopping



*A take-up for the chuck cord*

around, getting itself soaked with grinding compound, breaking the insulation and short-circuiting the current, and making a nuisance of itself generally on all forms of grinding machines, the tables of which reciprocate instead of revolve. Why don't some genius design a reciprocating table with a nice concealed sliding contact beneath it and do away with the messy cord altogether?

The next best thing to eliminating the cord completely is to provide some mechanical and automatic means of keeping it out of the way, and on long-stroke machines some such scheme is almost a necessity. The best means for the purpose that I have seen is installed on a large Brown & Sharpe machine in the Gridley shops of the National Acme Co. at Windsor, Vt., and is shown in the accompanying photograph.

At the end of the machine and far enough away from it to clear the table in its extreme left position, an iron-pipe standard is set in the floor, and to this standard, with the lower side of its periphery about level with the table of the machine, is attached a wooden sheave-wheel about a foot in diameter and an inch thick. Suspended from a beam directly over it is a similar sheave, and a third sheave, with a weight suspended from its axis, completes the outfit.

The electric cord passes in a horizontal line from the machine table to and under the lower sheave, and from thence up to and around the suspended sheave. From the upper sheave the remaining cord hangs in a bight, the other point of suspension of which is the cable-carrying conduit attached to a near-by beam. The weighted sheave rides in the bight.

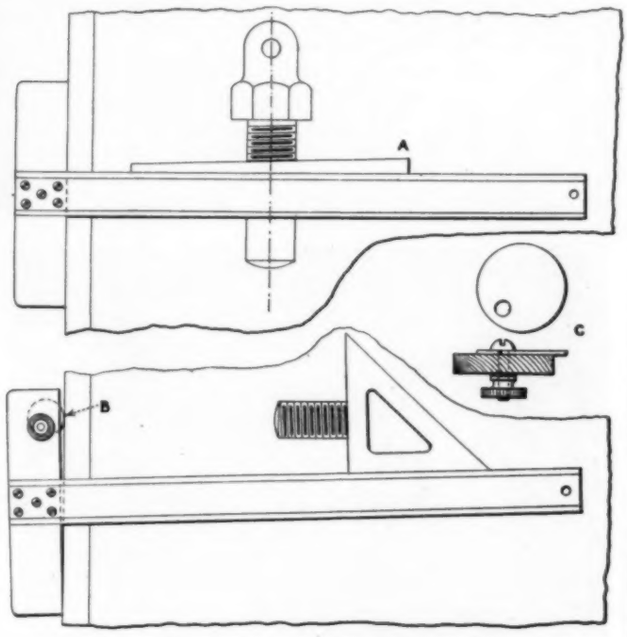
The action is obvious. The table is free to travel over the length of its stroke and as it recedes the cord is pulled from under the lower sheave and is "paid" (as a sailor would say) back to it as the table returns. The weighted sheave in the bight keeps the cord under uniform tension as it rides and falls, and there is never any slack.

## Attachment for Drawing Thread Angles

By C. E. Josselyn

The usual method of drawing the angles of threads, is to place a wedge-shaped piece against the upper part of the T-square blade, as shown at *A* in the illustration herewith. In reality, another piece is necessary to draw the angles on work where the center line is parallel with the T-square.

To take the place of these pieces I placed a thin disk, one inch in diameter, under the head of the square as




*Attachment for the T-square*

at *B*, attaching it with a machine screw and knurled thumbnut as may be seen in the enlarged portion *C*.

The disk can be adjusted to have the blade of the square set at any angle necessary for drawing thread angles, and then locked in position by the thumbnut.

For drawing angles of left-hand threads, the device can be placed at the lower part of the square head, or the square can be turned around so that the head will bear against the right-hand edge of the drawing board.

For drawing the angles of threads where the center line of the work is parallel, or nearly so, with the blade of the square, an ordinary triangle may be used.

## Hardening Reamers

By J. Spitzer

A few days ago I read a question by someone as to how to keep reamers straight in hardening. As I have had a little experience in this class of work, I thought perhaps my method might be of some help to others. It certainly worked well for me.

I use ordinary kerosene oil for quenching and put it in a vessed deep enough to allow the reamer to be submerged lengthwise.

Just before the reamer reaches the proper heat for quenching, I stir the oil rapidly with a stick so that it hugs the sides of the vessel and forms a funnel-shaped hollow in the center. The reamer is placed in the hollow spot and the oil closes around it as the circular velocity decreases, quenching it uniformly. The reamers come out exceptionally straight.

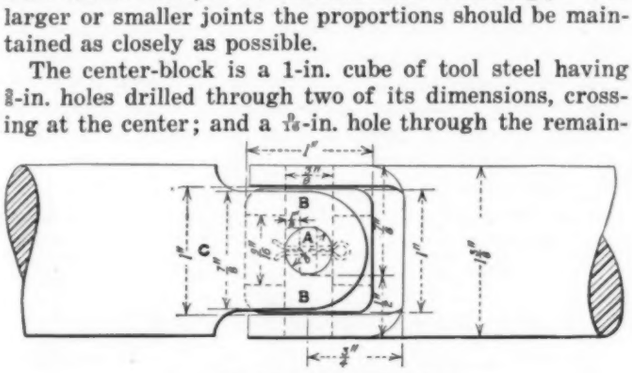
## An Easily Made Universal Joint

By W. F. Sandmann

A universal joint that is easy to make and possesses the advantage of having no threaded parts to work loose, or press or drive fits to make it difficult to disassemble, is shown in the accompanying sketch. When it is put together, all parts are held in place by a single split cotter-pin.

As the relative dimensions are of importance in making a joint that will have maximum strength for a given size, the sketch is based upon a joint having a 1-in. center-block, and is dimensioned accordingly. For larger or smaller joints the proportions should be maintained as closely as possible.

The center-block is a 1-in. cube of tool steel having ⅜-in. holes drilled through two of its dimensions, crossing at the center; and a ⅝-in. hole through the remaining dimension. Care should be taken to start the ⅜-in. holes at the centers of the respective faces, and to have them accurately square with the complementary dimensions of the block, as the facility with which the joint may be assembled and taken down depends somewhat upon the accuracy of the relation of these holes at the point of intersection. The position of the ⅝-in. hole is of less importance.




*A simple universal joint*

The axis pins *A* and *BB* should be a push fit in the ⅜-in. holes. Pin *A* is of full length and is flatted on both sides at a point midway of its length for a distance of ⅜-in. One-third of the diameter of the pin should be milled from each side so as to leave a web at the center of ½ in. thickness

The two pins *B* have two-thirds of the diameter milled away from one side at the ends leaving ears ½ in. thick. With pin *A* in place in the block, the ears of the two pins *B* are now fitted to overlap the flatted portion at the center of *A*, and a small hole for the cotter-pin is drilled at a right angle through all three pins. The ⅝-in. hole in the block provides ample clearance for this purpose and to put in the cotter-pin.

The jaw-ends are made of round stock 1⅜ in. in diameter. The jaws may be milled directly upon the ends of the shafts it is desired to connect, or they may be made as sleeves to be pinned to the respective shafts, The depth of each jaw from the center of the axis hole to the bottom of the yoke should be three-quarters of the dimension of the center-block; in this case ¾ in. The axis holes are ⅜ in. diameter and should be reamed to insure a free fit without shake for the pins.

To assemble the joint, the center-block is placed in one yoke and the axis pin *A* pushed through. The other yoke is then brought into position and the short pins *BB* pushed in until the ears overlap the flats of pin *A*, when the three parts of the cotter-pin hole are again in line and the cotter may be inserted, locking the parts together.

A joint of the type here described will drive successfully through an angle of 35 deg. without undue wear.

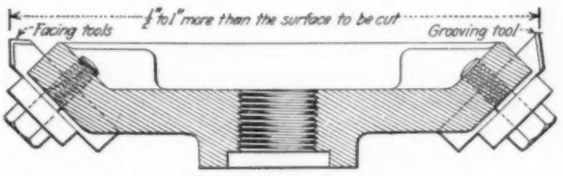
## Methods of Machining Pipe Fittings—Discussion

By James McIntosh

In an article under the title given above, by Joe V. Romig, and published on page 481, Vol. 60, of the *American Machinist*, Mr. Romig advocates a second cut to make a "shallow spiral groove, providing a surface that is ideal for holding the gasket." The use of a grooving tool set back of the surfacing tool would reduce the time to that of a single cut instead of two. Perhaps the use of a milling machine and a suitable fixture to register each of the three faces, using a single setting on a revolving upper plate, would speed up production. If the pivot were located properly, each face would be surfaced at the same table location and thus produce uniform fittings.

The writer had similar fittings to surface (a special job) and a simple cast-iron facing head, as per sketch, having ½x½-in. tools, was used in a milling machine. One of the tools was pointed and made grooves having a pitch equal to the feed, which was 0.125 in. The leading edge of the pointed tool made a series of grooves curved in one direction, while the trailing edge made a second series while passing over the face, with the result that the grooves formed a net-work design.

It is understood that the grooves were not deep enough to cause radial leaks. A shallow groove having slight radius is advocated as being sufficient to retain the gasket, and, where the fitting is attached to a straight length of pipe or a plain surface, the result will be quite satisfactory. So will be the cost of machining the faces of such fittings at a single setting, using the widest points of support to locate them.




*Cutter for facing flanges of pipe fittings*

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

## *Dangerous Railroad Legislation*

MOST people in a position to know its effects believe that the Transportation Act of 1920 deserves further trial before being scrapped. In consequence they look with apprehension on the Howell-Barkley Bill which proposes to restore the old national labor boards, introduce the closed shop and eliminate the public from such representation as it has on the present railroad labor board.

The bill has the full support of organized labor and may easily be passed if by so doing the Democrats and insurgent Republicans believe they can further embarrass the administration. On the first test the bill came very near being called from committee and placed on the calendar, only a Republican filibuster preventing it. Before this is published the second attempt, scheduled for May 19, may be successful.

As we see it the issue is whether the railroads of this country are to be run for the stockholders by the existing managements or whether the railroad unions are to be given the power to run things to suit themselves. There was a time when the issue was clearly drawn bebetween a few large owners on the one hand and the employees on the other. But the railroads are no longer in the hands of a few big capitalists as is shown by the hundreds of thousands of registered railroad stock owners. The people who have put their money into railroad securities deserve consideration and are entitled to some measure of protection from their representatives in Washington.

## *Aviation Is a Mode of Transportation—Not a Sport*

IT IS unfortunate but true that only the unusual events are chronicled and especially headlined as news. And it is well to remember this before passing judgment on matters that appear in the daily press.

Murders and other forms of law breaking are featured because the average citizen does not commit them. In the same way accidents to railway trains, automobiles and airplanes are given scare heads until some are led to believe it is the common, rather than the unusual experience.

It is particularly well to remember this in considering the newer mode of transportation, by airplane. Thousands of flights are made without mishap or even incident of any kind. But the forced landing, the more or less serious accident, is broadcasted far and wide and cannot help but make the average man look upon aviation as a dangerous pastime.

Few who have not kept informed regarding air travel can appreciate the advances which have been made both in airplanes and the knowledge of handling them. Not many years ago, fair weather and little or no air stirring was necessary before a pilot would feel justified in taking a plane up. A visit to any flying field today will show a great change in this respect. It takes a very windy day to interfere materially with the flying program. The wind may whip the sea into white caps and make it uncomfortable for even moderate sized boats, but the air mail pilot takes his plane up, flies across country, and delivers the mail. And on the average he comes nearer to being on schedule than the railroads.

It is time that we think of aviation as a method of transportation rather than as a very dangerous recreation. The increased use of the plane for commercial purposes will still further reduce the hazard by providing suitable landing places at frequent intervals. The sooner we recognize its place in the business world, the faster will be the development of the new industry.

## *Manning Our Machine Shops*

IN SPITE of apprenticeship training systems there seems to be a feeling in many sections of the country that we are not getting and holding as many boys and young men in our machine shops as the industry demands. Many reasons are given which include social ambition of boys and their parents, the lure of wages paid in the building trades and pure cussedness on the part of the boys themselves.

As Old Man Johnson's son, Tom, says in John R. Godfrey's article on another page, it is probable that all of these reasons play a part but that no one of them is wholly responsible. The article points out some of the sore spots in many shops, such as machine operators getting more money than all around men who have been trained in your own shop.

It also suggests a few remedies. Just how good they are or how practical, each manager must judge for himself. Some of them, at least, are being used. Most of us will agree, however, that the machine industry is not fully appreciated in most localities and that much can be done to sell the idea of its real importance to most communities.

## *The Metric Enthusiasts Once More*

AT THE recent meeting of the Chamber of Commerce of the United States another attempt was made by the gentlemen who desire us to adopt the metric system to put the question before the Chamber for a referendum vote. Their case was ably presented before the meeting of the National Councillors but without much effect. So many speakers desired to present the opposite side that only a few of them could be heard. The vote against presenting the question to the membership of the Chamber was something like ten to one, showing conclusively how the American business man feels about it.

Unfortunately the metric proponents are true fanatics and will not be discouraged by the overwhelming numbers of their opponents. We have seen before what a well-organized and enthusiastic minority can do in Washington and it will therefore pay to keep an eye on this movement to overthrow existing standards and to substitute in their stead others that are not wanted and that for most purposes would not be so good.

# Shop Equipment News

## Stockbridge 32-In. Heavy Duty Crank Shaper

A heavy duty crank shaper has recently been placed on the market by the Stockbridge Machine Co., Worcester, Mass. This machine has a stroke of 32 in. and the design and construction of the machine have been planned to secure the necessary rigidity required in a machine with such a long stroke.

A feature of the mechanism that secures additional rigidity is the provision of an outer ring bearing on the side of the bull gear opposite the hub bearing. This outer bearing eliminates the usual overhang of the bull gear; it consists of a ring fitted into the column and is located close to the rocker arm. A finished journal at the outer edge of the periphery of the bull gear revolves in this bearing and is lubricated by means of rollers in oil wells. Both the bull gear and its driving pinion have helical teeth.

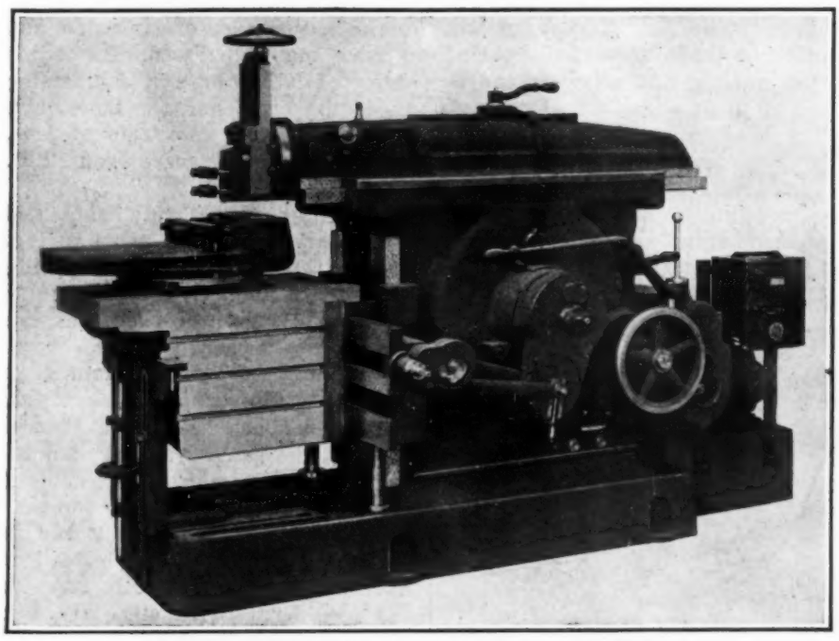
The box-section ram has square guides and wear is taken up by two full-length solid gibs. The ram can be positioned and the length of stroke can be adjusted without stopping the machine. Eight ram speeds are provided, ranging from 6 to 92 strokes per min. These speeds are obtained through a four-change, selective, sliding-gear speed box and a set of back gears. The gears are heat treated and run in grease. The idling of the back gear shaft when the machine is running on open belt can be prevented by means of a suitable device.

The ram head has a graduated swivel for setting at an angle. The clapper box has a planer type solid binding clamp, the clapper being fitted with straps and bolts instead of the usual tool post. Power down feed can be furnished, if desired. The total feed of the tool slide is 10 inches.

The crossrail is elevated by two screws through a distance of 15 in. The saddle is gibbed to the rail, the table being fastened to the saddle by bolts and a hook that fits in a slot. The table has two working sides and can be easily removed to permit clamping work directly to the saddle. The outer table support gives a bearing for the full width of the knee and is provided with an elevating screw.

The cross feed operates only on the return of the ram, feeding during the ram stroke being impossible. The feed is automatic and can be varied or reversed while the machine is in motion. Any length of feed up to $\frac{5}{8}$ in. per stroke is available.

For belt driving a single constant-speed pulley is used and operates the machine through a friction clutch and brake. The clutch is controlled by a long lever at the operating side of the machine. For a motor drive the apparatus is arranged as shown in the accompanying illustration, the motor driving the speed box through gearing. A 7½- to 10-hp. motor is required and should run at 1,750 r.p.m. The motor is mounted on an extension of the base.



*Stockbridge 32-In. Heavy Duty Crank Shaper*

## "Lumnite" Cement

A hydraulic cement with high alumina content and exceptional setting qualities has recently been placed on the market by the Atlas Aluminate Cement Co., 25 Broadway, New York, N. Y. This product has been designated "Lumnite" cement and its characteristics make it of interest in industrial plants for construction and repairs.

Besides possessing the qualities of ordinary Portland cement, this material develops strength in twenty-four hours somewhat greater than that of Portland cement at 28 days. Structures may be put in service or machinery set on foundations twenty-four hours after pouring, and reconstruction or repair of concrete floors and structures can be completed ready for service during the week-end period.

The raw materials used in this cement include a large proportion of high grade aluminum ore. The cement is used in the same way as Portland cement except that a somewhat wetter mix should be used on account of its more rapid setting

qualities. The material allows the usual time for mixing, transporting and pouring, the strength developing with great rapidity immediately after setting. It is said that similar cement has been used in France for some years with great success.

## United States Combination Wheel and Disk Grinder

The United States Electrical Tool Co., Cincinnati, Ohio, has recently placed on the market the combination wheel and disk grinder shown in the accompanying illustration. This machine is motor-driven, the spindle carrying an abrasive wheel of the standard type at one end and a 24-in. grinding disk at the other.

The spindle rotates at 1,120 r.p.m. and the motor capacity is 5 hp. The

*United States Combination Wheel and Disk Grinder*

work to be ground on the disk is attached to the table in which suitable T-slots are provided. The handle attached to the table and projecting in front of it permits hori zontal movement of the table, when required for certain classes of work Angular adjustment of the table is possible after loosening a clamp.

When it is necessary to oscillate the table the weight is used as a counter-balance. The table has a vertical adjustment also. For holding the shaft stationary when removing the wheel clamping nuts, a self-releasing pin is pushed into one of four slots in a disk attached to the spindle.

The abrasive wheel end is fitted with a hinged wheel guard with an exhaust connection. Push-button control is provided for the motor.

## Cisco Geared-Head Lathe

The Cisco Machine Tool Co., Cincinnati, Ohio, is now marketing a recently developed style of selective geared head lathe, especially designed for efficient operation, ease in handling, and durability. The machine can be furnished in five sizes, ranging from 14- to 26-in. by 2-in. increments.

A feature of the lathe is the geared headstock illustrated in

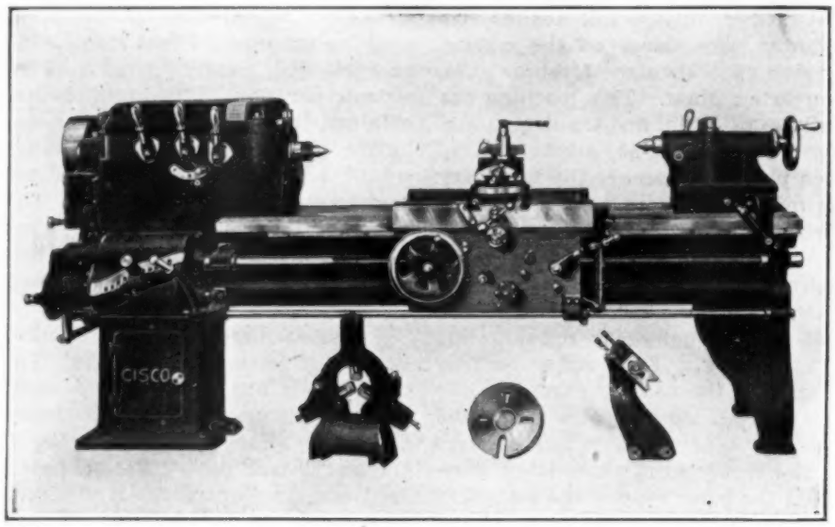



*Fig. 1—Cisco Geared-Head Lathe*

Fig. 2, in which all the shifting mechanism is contained. The cover contains no mechanism and can be easily removed. The spindle is made of high-carbon nickel-steel and is mounted in main bearings, constantly oiled from two large oil pockets. The end thrust of the spindle is borne by a ball bearing thrust washer, and all wear can be taken up by an adjustable thrust nut.

The headstock gears are made of alloy steel and all high-speed gears are hardened and ground. All gears are constantly in mesh and 12 changes of spindle speed in geometrical progression are obtained through positive clutches. These hardened

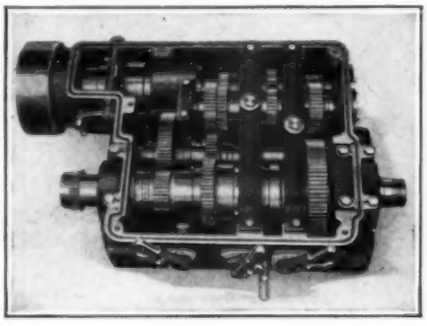


*Fig. 2—Headstock of Cisco lathe*

clutches have been designed to eliminate clash in shifting from one speed to any other. No two speeds can be engaged at one time. All gears and clutches run in a bath of oil. All headstock shafts are mounted in ball bearings, each shaft and its appurtenances being an independent unit to facilitate replacement.

The power from the main driving pulley is transmitted through an adjustable friction clutch, in which a quick-acting brake for stopping is incorporated. Convenient operating handles for operating the clutch are provided at both apron and headstock. The driving pulley is supported by two ball bearings.

The bed is made of semi-steel and is heavy and well-ribbed. All of this series of lathes have a cabinet leg under the head, and the 20-in. size and larger have two cabinet legs, when the beds are more than 12 ft. long.

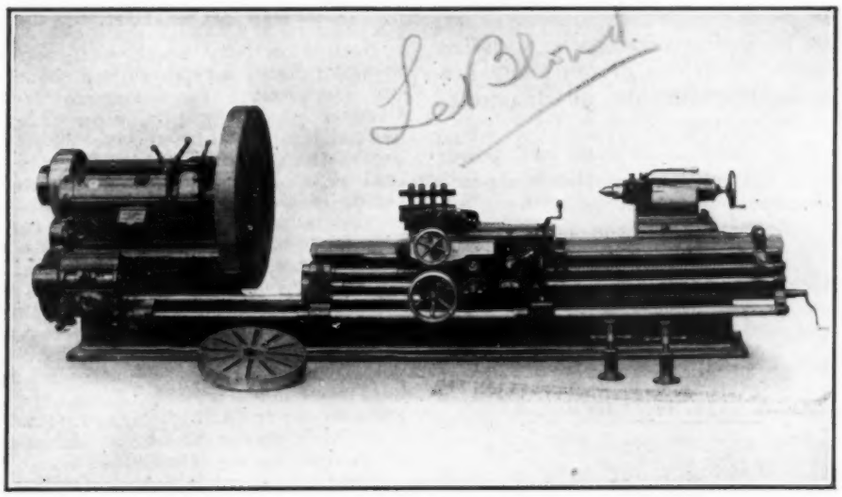
The carriage has a wide bridge and long bearings on the ways and is fitted with adjustable gibs for taking up wear. The apron is of the double plate type, in which the feeds are obtained by means of a steel worm and bronze wormwheel running in oil. Longitudinal and cross feeds are independent but are controlled through the same friction. An interlock prevents the engagement of thread and feed at the same time.

The tailstock spindle is locked in position by a plug clamp instead of having a split barrel. All gears in the feed box are of steel, the box being securely fastened to the bed by bolts and dowels.

# LeBlond Geared-Head Sliding-Bed Gap Lathe

A recent addition to the line of lathes manufactured by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, consists of a series of geared-head, sliding-bed, gap lathes. feeds are operated through a single positive clutch, an interlock being provided so that both feeds cannot be engaged at the same time.

All quick-change feed gears are of steel and all changes are made by the operation of two levers. A separate feed rod is provided and the lead screw is not splined. A range of 48 feeds are provided. Special coarse leads or metric screws can be cut by the addition of gears at the end of the gear box. The usual standard and extra equipment is furnished.



*LeBlond Geared-Head Sliding-Bed Gap Lathe*

The lathe is built in three sizes with 19-, 25-, and 33-in. swings over the shears, and 38-, 50-, and 60-in. capacities in the gaps, respectively.

The headstock of the machine is massive in construction and provides 16 spindle speeds in geometric progression. These speeds are selective and are obtained by means of two levers. All gears are heat-treated, the sliding gears being made of chrome-nickel alloy steel. Multiple keyways in the gears are broached from the solid and the shafts have multiple hobbed splines. The constant-speed driving pulley runs at 515 r.p.m. and drives the machine through a multiple disk clutch and brake. The spindle is started and stopped from the apron or the headstock.

The top bed is movable on the lower bed, the movement being obtained by means of a screw of coarse pitch. The upper bed is kept in alignment by a V on the lower section and is clamped in position by two heavy clamps. This arrangement allows the position of the upper bed to be adjusted to provide any width of gap and increases the length available between centers.

The rear carriage bearing is flat, the front shear being of the compensating V-type to resist tool pressure in all directions. The apron is a one-piece, box-section casting. Both

## Foster-Johnson Reamer Sharpener

A device to facilitate the sharpening of reamers by hand has recently been placed on the market by the Foster-Johnson Reamer Co., Elkhart, Ind. The apparatus is designed to accommodate the general run of solid and adjustable reamers up to 2½ in. in diameter.

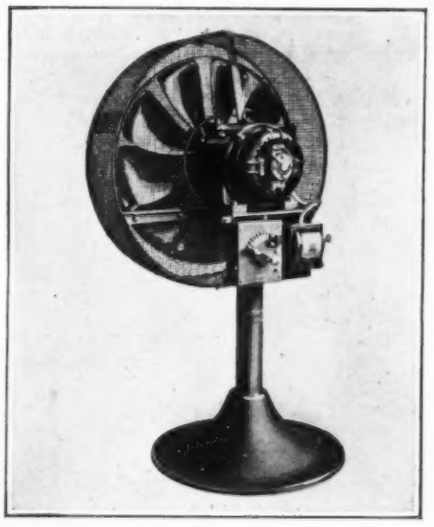
The reamer is held on two centers that can be clamped in various positions in the frame bearings. A tooth rest on the back side of the machine holds the reamer blades in the correct position for sharpening, as shown in the accompanying illustration. On the front of the device an adjustable support for the hone carrier is located, this support being raised or lowered to suit the angle of the reamer blades.

*Foster-Johnson Reamer Sharpener*

The hone is moved back and forth over the reamer blades by hand until the blade has been properly sharpened. The maximum distance available between centers is 12¾ in., the minimum being 4 in. The size of the hone is ⅝x1½x4½ inches. A larger size than that shown in the illustration is also made and is for use on cylinder reamers.

## Ventura Man-Cooling Fan

An improved model of "man-cooling" fan is now being marketed by the American Blower Co., Detroit, Mich. This apparatus is built in two sizes with wheels 21¼ and 37¼ in. in diameter, respectively. The smaller fan operates at 1,725 r.p.m. and is equipped with a 1-hp. motor, the larger size being driven at 1,120 r.p.m. by a 4-hp. motor.



*Ventura Man-Cooling Fan*

The device is strongly built and runs at a slow speed that tends to give a long period of service for the outfit. The unit is self-contained with the switch and starting-box mounted directly below the motor and can be placed in any desired position around the plant where the men are exposed to severe heat conditions. The rotating fan is well guarded by a heavy wire screen attached to the frame.

# Betts Special Planer Type Slotter

A large special machine tool of unusual design has recently been built by the Betts Machine Works of the Consolidated Machine Tool Corp. of America, Wilmington, Del. This machine is a planer type slotter and is shown in the accompanying illustration.

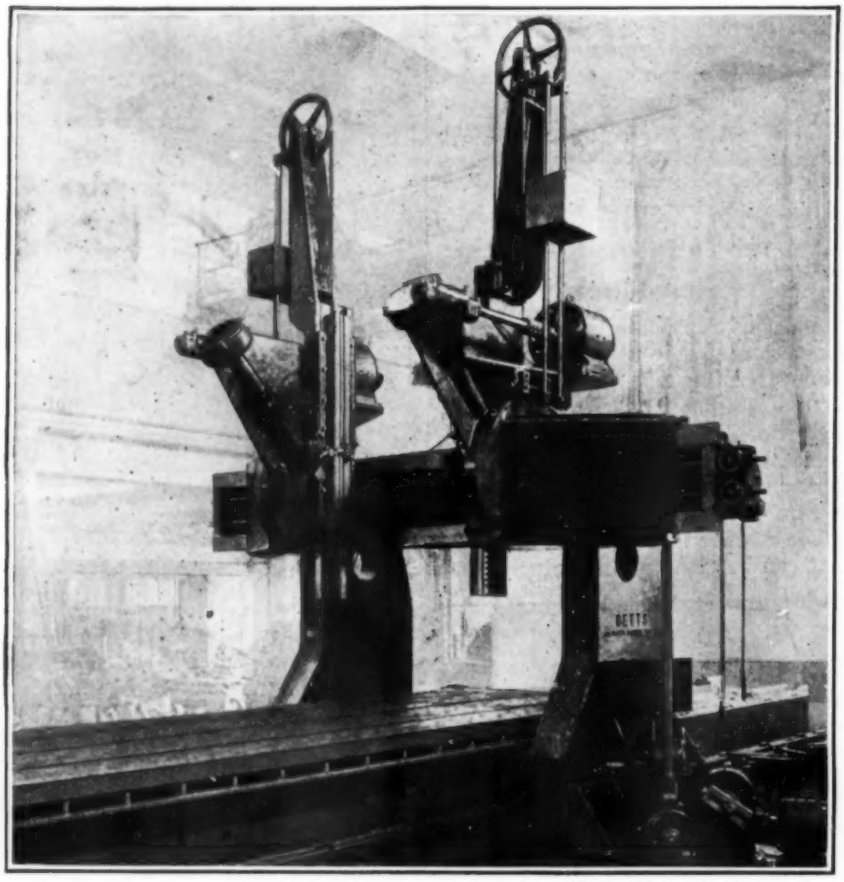
The bed and table of the machine are of the conventional planer design, the table being guided on one V and one flat track. The table tracks are automatically lubricated by means of oil pockets and rollers. The working surface of the table has suitable T-slots and stop holes properly spaced for clamping the work.

Two heavy uprights are fastened to the base and carry a fixed cross-rail of wide face and deeply arched at the back. Two saddles are mounted on the rail and carry the slotting rams. Provision for slotting at an angle is made by mounting the rams so that they face each other, the swivelling saddles providing a maximum inclination of 2 in. in a 12-in. stroke. Each saddle is swivelled by means of a worm and segment.

Each ram is driven by a 20-hp. reversing planer type motor, the motor for each ram being carried on the saddle and driving through an angular shaft, worm gearing and a rack. Each motor is equipped with automatic control, electrical synchronization being provided to keep the rams working in unison. Each ram is counterweighted by a sliding weight. A power driven pump furnishes lubricant to all important saddle bearings.

Each saddle has feed and power rapid traverse along the cross-rail, the power being furnished by a 15-hp. motor. Feed and power rapid traverse are selective and can be engaged and disengaged from the operator's position on the floor. The cutting and return speeds of the rams are adjustable through planer type control panels. The table is also provided with feed and power rapid traverse movements along the bed, and is driven by the same motor that moves the saddle on the rail. An interlocking arrangement makes it impossible to engage the table and saddle motions at the same time.

The machine shown in the illustration has a width of 10 ft. 2 in. between the housings, a height of 5 ft. under the saddles, and the slotting rams have a 48-in. stroke. The table is 30 ft. long between pockets, and has a width of 9 feet.




*Betts Special Planer Type Slotter*

## How Industry Fares in European Countries

Normal activity in French cotton spinning plants is reported in a cable to the Department of Commerce from Commercial Attache Chester Lloyd Jones. Spinners in the north have orders three months ahead. The general situation in the cotton manufacturing industry is healthy, with stocks of yarn and cloth low and prices firm. The labor shortage continues. Conditions in wool manufactures are also satisfactory.

Foreign orders for French metallurgical products have been restricted by the depreciation in franc value, and imports of British semi-finished products have been made possible, forcing local mills to lower their prices. An early price stabilization and the resumption of foreign buying is expected.

Domestic sales in automobiles are brisk and factories are working to capacity; export orders, however, have decreased. The machinery trade is active. It is reported that increased orders have been given to American and British machinery manufacturers. There is a busy demand for agricultural machinery and heavy imports continue strong.

The unemployment situation improved during April. The number of persons receiving unemployment relief diminished by 2,200, totaling 9,000 on April 29.

French exports in March, 1924, were valued at 4,355,000,000 francs, while imports reached a value of 3,623,000,000 francs, giving a favorable balance of 732,000,000 francs. Exports in the first three months of 1924 amounted to 6,579,000 metric tons, with a total value of 10,973,000,000 francs. The quantity of imports was 13,151,000 tons, of which coal constituted 7,503,000 tons. The value of imports totaled 10,224,000,000 francs.

### Other Countries

The domestic boom in Germany which followed the stabilization of currency continues but industry is being hampered by acute shortage of credits. Credit shortage is still more serious in Poland where, largely on this account, industry is operating at only 40 per cent of normal. Business is dull in Austria and the slump in stock exchange securities continues. Some small dealers have become insolvent but the large banks seem to be standing the strain. Increased exchange value and stability of the Spanish peseta favor importation of goods from the United States. Spanish domestic business is better. Scarcity of low-priced homes is stimulating the building trades. Railroad construction also is increasing. Rumania continues negotiations for settlement of foreign claims against Rumanian business houses.

# News of the Week

## Ohio Foremen Gather in First Convention at Cash Register Plant

### *Important conference shows trend toward industrial peace*

The beginning of what promises to be a large and important movement in industry was made in Dayton, Ohio, on May 14. About 1,000 delegates from all over Ohio, together with a few from Indiana, met at the first convention of the Ohio Federation of Foremen's Clubs, at the famous Schoolhouse of the National Cash Register Co. The program was well carried out, on schedule time and included lunch at Triangle Park, a visit to McCook Field with exhibition flying, a trip through the National Cash Register plant and dinner in the large dining hall of the company.

After addresses of welcome by Dr. Garland of the National Cash Register Co., and C. P. Moore of the Chamber of Commerce, President T. B. Fordham gave an outline of the inception and growth of the Dayton Foremen's Clubs and the broadening of the work into a state federation. From a handful five years ago the Dayton Club now numbers nearly 800 members who study shop management, visit the factories of Dayton and vicinity, and endeavor to become better executives and better citizens.

#### Profits Necessary

Mr. Fordham pointed out that the first consideration of all business must be a money profit, in order to continue in business and expand. But there are also other profits to be considered—the workers must profit in good wages and the customers must profit in satisfaction. The modern foreman must be not only a production getter, but a real leader. Shops should be open to inspection as those who give, get more in return. The Dayton Foremen's Club has a service committee which assists in solving the problems of any member by putting him in contact with the men best fitted to aid in his particular case.

The successful shop must pay suitable wages, be comfortable to work in, have good management, provide a steady job and an opportunity for advancement either in position, satisfaction, friendship or respect of the executive. The foreman works for the men as well as for the management and can do more to maintain harmony than anyone else.

A paper by J. C. Haswell, president of the Dayton Malleable Iron Co., was read by Secretary Whipple in which it was stated that with the new ideas now coming to the front, the foremen would have the deciding voice in the policies of shops and the national welfare. Industry is undergoing a great change and opposing its evolution might bring revolution. We must have co-operation. Employers must find a way of carrying out their desire to be fair. This can best be done through the foreman who, when he is himself convinced, can make the policies and ideals clear to the men.

#### Leadership in the Shop

Mr. Clark, manager of a large non-mechanical business in Cleveland, gave a spendid talk on modern production in which he showed that the big item was not machines but men, no matter of what type. Leadership brings its penalties and also its compensations. The real leader is the man who believes in and loves men in spite of their faults. A foreman can frequently do more toward securing the respect and confidence of his men outside the shop than in, by his work and life in the community. The real foreman is not the boss, but the friend of every man who works with him. This kind of a foreman can and will tell a man when he is not making good, tell him why, and how he can improve.

D. J. MacDonald told of the work of the Ohio State University in co-operation with the State and Federal Governments in training foremen. Even some large concerns knew nothing of the work but one firm saved $95,000 which it would have spent with a private school. This is part of the newer ideas of an educational system which gives everyone, at any age and at any time, the education they want for their life work. Mr. MacDonald spoke of the help that he had received from foremen's clubs in overcoming suspicion and antagonism. Only the right spirit overcomes suspicion and gets the message across.

#### Promotion from the Ranks

Wm. Hartman, factory superintendent of the National Cash Register Co, outlined the policy of the company in promoting from the ranks, in conferences and in study to fit men for higher positions. As foremen represent the company to the men, special care is taken to see that they fully understand the ideals and policies. To this end they have a foremen's school, where ideas are interchanged, where questionable practices are discussed without embarrassment to the individual.

Among the other cities represented were Piqua, Springfield, Middletown, Lima, Cincinnati, Portsmouth, Lorain, Youngstown and Richmond, Ind. Short talks were given by men from the different centers, outlining the work in their localities. Over 400 out-of-town men were registered.

## Manufacturers Hold Annual Meeting

Many interesting features were taken up at the annual convention of the National Association of Manufacturers held at the Waldorf-Astoria Hotel, New York City, May 19, 20 and 21. Sessions were scheduled for Monday morning, afternoon and evening, Tuesday morning, afternoon and evening and Wednesday morning and afternoon with the annual convention dinner in the evening.

One subject, "The Truth About Russia, Industrially," which is of vital importance to every manufacturer in the country at this time, was taken up Monday evening with three speakers being heard. All three of these men had recently returned from Russia and other parts of Europe and spoke from first hand knowledge.

Other subjects that were discussed at length were: the open shop, industrial relations, linking the shop with the office, the "platform of industry," immigration, taxation, the coal situation and a speech by James A. Emery on "The Political and Legislative Horizon."

It is estimated that there was present a much larger number than last year. One of the features of the entertainment was the dance and reception held after the dinner on Wednesday evening.

A further report of the matters of interest to readers of the *American Machinist* will appear in the issue of May 29.

## Still Unable to Get Mobile Machine-Shop Units

Another effort to secure distribution to the states of a portion of the 800 ordnance mobile machine-shop units failed when the Senate Committee on Military Affairs declined to include 500 of these units in a bill, proposing such distribution of 4,000 War Department trucks and 1,500 tractors.

The Ordnance Department contended that these mobile machine shops are of highly technical design and cannot be replaced readily. The Committee was advised that the War Department is being particularly careful to keep these mobile machine shops in good condition. The entire 800 are being kept in closed storage, where deterioration is kept at a minimum.

# Outlook for the Machine Tool Industry

**Our entrance into a new era of economic history—The stoppage of immigration—Lack of export demand—What the future holds for the machine tool maker**

**By R. E. Flanders**
President, National Machine Tool Builders' Association

WE HAVE met here today to open our semi-annual meeting for acquaintanceship, conference, and the mutual exchange of ideas and experience. In accord with established custom it now devolves upon your president to give as comprehensive a statement as he can prepare, of the state of the industry, of the state of business as a whole, and of the prospects for the future, so far as they can be discerned. That duty I now take pleasure in fulfilling.

The outlook, indeed, is far from pleasant. We have had a year or more of general prosperity in the industries, tempered by dissatisfaction in the farming areas. The industrial prosperity has been such as to permit of record breaking business in some branches—notably in the steel industry, in transportation, in electrical machinery and in the automotive lines.

All of these branches are important customers of the machine tool industry, yet that has languished. Our barometer shows that the average rate of output for 1923 did not exceed 36 per cent of that for the first quarter of 1920, which is taken as a normal period; and the average rate for the first four months of 1924 is somewhat less. Now general industry itself is slowing down, and the prospect looks still more dubious. What is the reason, and what is the remedy?

In accord with the trend of the times and assisted by the work of our capable Manager, Mr. Du Brul, we have all been getting a clearer picture of the real character of the machine tool industry and of its relation to the general economic situation. We know that its product is several removes distant from the ultimate consumer, and is therefore subject to violent fluctuations in demand unknown to the producer of flour, shoes and news print paper. People must have some provision of food, clothing and shelter, even in the hardest times, if they are to exist at all; but the country can run on for many months without new machine tools—and in hard times it does it.

### A Sensitive Market

Furthermore, the demand for machine tools to make the machinery to make the ultimate product does not appear for some months after the demand for the product itself shows a marked increase; but the machine-tool market drops off instantaneously under the first chill breath of an expected recession of demand on the part of the ultimate consumer. The periods of high demand are thus much shorter than those of other industries, as well as more violent.

But all of this is now a commonplace in our own conception of things, however little it may be understood by our customers. There does, nevertheless, seem to be need for a still more fundamental examination of our situation, if we are to steer a true course for the coming months and years. That examination we may well pursue this morning.

The first basic factor in our situation is that our normal rate of output has in the past been largely absorbed by the expansion of industry in this country. Replacement and maintenance of existing equipment would call for a comparatively small percentage of the available machine tool building capacity.

### New Era of Economic History

The second basic factor is that the United States has definitely entered on a new era in its economic history—one in which we may safely predict that the rate of industrial expansion will be slower to a marked degree than it has been in the past fifty years. The causes of this slower rate of expansion are also two: The disappearance of public lands of agricultural value, and the practical stoppage of immigration.

Of these phenomena, the taking up of the public lands is the more obscure in its effects, but is not therefore the less certain or important. A country with a constantly advancing frontier is of necessity a country of expansion. It is a country of growing population, with increasing demands for clothing, shelter and implements of all sorts. In ways which we well understand, this is reflected in enlarging requirements for machine tools.

The stoppage of immigration is an indirect result of the disappearance of valuable public lands. It is only in part due to a fear that our institutions are endangered by the incoming mass of aliens with ideas and ideals foreign to our culture. The real driving power of the sentiment behind restriction is the subconscious appreciation in the mind of the average citizen of a change in living conditions—of a gradual increase in the severity of competition. He is no longer willing or able to cope with immigrants of lower economic standards, whatever their social standards may be.

Lessened immigration evidently slows up the increase of population and thus directly restrains industrial expansion and machine tool demand. It does the same thing indirectly by cutting off the available supply of rough labor, and thus hindering many large engineering and constructional projects, which if put through to completion, would have a beneficial effect on our business.

There are of course other causes of the depression in which we find ourselves. There is little foreign demand in the countries which used to be good customers. The industrial and economic disorganization of the war has but recently shown signs of recovery. The newer industrial countries—Japan, India and China—have not developed rapidly enough to fill their places.

And then there is a final factor, fascinating, but highly problematical. It may be that we are approaching the end of the age of invention. This has often been prophesied in the past, always with resulting discomfiture to the prophet. But it does clearly appear that the most spectacular inventions of our day are of less human significance than the humbler developments of past generations.

We are on the eve of a thirty-six hour aerial mail service between New York and San Francisco—a truly astonishing development, involving problems of organization and scientific research undreamed of sixty years ago. And yet it is scarcely that length of time since the first crude railroad connection displaced the "Covered Wagon" on the Overland Trail. Can this recent event by any possibility have the effect on the history of our country that the earlier one did?

Millions listen nightly to the eerie magnifications of invisible, inaudible, immeasurable pulsations of the ether. We call it the "radio." With it powerful sending stations girdle the earth. It remains the highest triumph of scientific imagination and analysis. But will it revolutionize the history of the World as did its humbler progenitors, the first steamboat and the Atlantic cable? Do not thoughts like these drive us to the conclusion that the real work of the coming age lies in the perfecting of the social structure—the solving of the problems of the production and distribution of wealth, along lines which will enhance the general health and happiness of the average man and his family?

### The Barometer of Expansion

But I am digressing. It is proper that I should return to a consideration of the state of the Machine Tool business, and of the policies to which that state directs us. It is sufficient if the more general discussion has emphasized two facts: First, that our industry is only in part a barometer of business activity; it is pre-eminently a barometer of business expansion. Second, it is sensitive to major social movements quite beyond our control; we must adapt ourselves cheerfully to new conditions, for there is no hope in any attempt to pull backward up the stream of history.

The present condition, then, is that our industry has grown to supply the needs of a general industrial expansion which has for the present slowed down—plus the needs of an acute war time expansion—which we devoutly pray may never come again. What are the

Presidential address made at the meeting of the National Machine Tool Builders' Association, Buffalo, May 22, 1924.

prospects for getting business to employ our idle plant, equipment and workmen? Let us explore the possible channels of improvement, one by one.

In the first place, there is always the hope of some new and rapidly growing development, as typified by the bicycle, and later by the automobile. The truck, the tractor and the airplane have in turn been hailed as worthy successors to the first two, but so far their influence has been disappointing. They may be counted on however for a more or less steady growth which will produce benefits measurable in the long run.

There will be again a steady growth of our machine-made civilization, quite irrespective of an increase of population. As an illustration I have used the fact that all this past winter in my home town, in the extreme northeast section of the country, it was possible to buy the most delicious ice-berg lettuce at 10 cents per head, or two for a quarter. Inquiry revealed that it came from the Imperial Valley, 2,500 miles away as the crow flies, and 1,000 miles further by rail. This is typical of the increasing service rendered by an advancing civilization. It is based on an elaborate organization of personnel and equipment—of trucks, agricultural machinery, refrigeration, cars and locomotives—all in turn based on the machine tool as a foundation.

Added to this expansion of civilization will be a certain degree of expansion of population, due to natural increase irrespective of immigration. This will demand its small share of industrial expansion, with a consequent demand for our product.

### Immigration and Machinery

Furthermore, in judging of the effect of restricted immigration, we have to reckon with the fortunate fact that it will directly increase the demand for machinery, thus compensating in part for the sinister indirect influence already described. So called "rough labor" is slowly but steadily disappearing from the fair face of our land. The Italian, the Hungarian, the Pole, the Russian, are leaving the ranks of the day laborers and climbing the social ladder. There is plenty of room at the bottom, with no one to fill the room. The last ten years have seen a remarkable development in contractor's and other types of machinery designed to fill the place of the day laborer. That development is bound to continue, and will offer us its share of sustenance.

No more pregnant scene has come to my eyes than appeared around a bend in the road the other day, a few miles from my home. The State Highway Department is removing some dangerous curves at this point, and the work necessitates the blasting away of several spurs of hard granite rock. Fifteen years ago the blast holes would have been sunk by three laborers, one of them holding a drill while the other two wielded hammers. That was not what I saw last week. There was only one man visible; but he had a heavy truck, on which was mounted a portable gasoline engine connected to an air compressor. From its receiver a rubber hose led to the up-to-date pneumatic drill which the lone workman was operating. Fifteen years ago—three men and five dollars worth of equipment. Today—one man and five thousand dollars worth of equipment. Changes like these give us courage for the future.

There is one disturbing reflection to be drawn from this picture. An expenditure of capital was required for the modern method one thousand times greater than was needed in the old day. While this ratio is unusual, it but emphasizes the fact that the diminishing forces of rough labor can only be replaced by an enormously increasing investment. Organized labor must recognize this if it is to realize its fondest hopes in the elimination of ill-paid drudgery and underpaid competition. The present situation, under which the great reservoirs of capital are poured into tax-free bonds rather than into the channels of industry, constitutes the largest single handicap to the prosperity of manufacturer, workman and farmer alike.

### Replacing Equipment

Last on the list, but not least, are the opportunities offered by the replacement of obsolete equipment. Many factors are required to bring success along this line. Among them are: A product kept up to date, of the best possible design, materials and workmanship in view of all the requirements of the situation; specialized, intelligent, persistent salesmanship, to overcome lethargy and skepticism; a farsighted viewpoint on the part of the customer; and, finally, as in the previous instance, conditions favorable to an abundant supply of capital for industrial improvement.

These, then, are the conditions in which we find ourselves. What shall we do about it? It is to consider this problem that we are met together this morning. Decisions have to be made in the fields of design, manufacture, financial control and salesmanship. Our program is devoted to the last two of these. We take up salesmanship today—financial control tomorrow. Let each of us bring to these discussions the very keenest intelligence we can muster, freely giving to all the best fruits of our experiences and capacities.

As I look over the records of previous meetings, it would appear that a forecast or prophecy of the future is required from the president at some point in the proceedings. Last fall Mr. Kearney, as you will remember, prophesied that business for 1924 would be "neither bad nor good." He was perhaps slightly over-optimistic.

My own prophecy would be that we are faced by several months of business that will be neither desperately bad nor "rather poor," but somewhere in between. Beyond that point the indications on which I have elaborated appear to point to a gradual improvement extending over a period of years. We may reach our full capacity in three to four years, or it may take ten to fifteen. The question of how long it will take to arrive at the desired consummation depends mainly on two elements: A wise measure of tax reform, and an increase in confidence and fair dealing between the various elements of the social structure.

The advance in business during this period will not be uniform. The cyclic fluctuations will still continue, but with lessened violence. The high points will not be so high, nor the low points so low, as in years past. The lesson of the business cycle is being learned, and every individual manufacturer who adjusts his own business to it assists in soothing its perturbations.

A friend of mine, traveling in Japan, fell in with a Japanese student—a slender youth with large glasses. In a conversation that ranged the whole field from religion to the metric system, my friend inquired whether or no he were an optimist. After careful thought the student replied "I am an optimist, but neither a hasty nor a superficial one." We have reason to be optimists, but we will be wise to follow the lead of our young Japanese friend, rather than to pump ourselves up to the bubbling enthusiasm of a Babbitt. May we have optimism, but let it be neither hasty nor superficial.

This is not a sermon and needs no text. Yet, may I invite your attention, not irreverently, to the thirteenth verse of the sixteenth chapter of St. Paul's first epistle to the Corinthians: "Watch ye, stand fast in the faith, quit you like men, be strong."

## Link Belt Business at 85 per Cent

The manufacturer of materials-handling equipment has an unusual opportunity to be informed on business conditions generally, for his product goes into practically every industry. For that reason there is special interest in the production activity of one of the large manufacturers in that line.

Speaking to a representative of the McGraw-Hill Co. recently, Charles Piez, president of the Link Belt Co., summarized briefly the status of their business.

"Our plants as a whole," said Mr. Piez, "are running at 85 per cent of their normal 48-hour per week capacity. The Philadelphia plant in January, February and March did not show up so well, but there has been a large increase in orders and production in April and we look for a continued upward trend in the Eastern territory. For the Middle Western plants business has been brisk and the same applies, but in increasing measure, for the West Coast plant and office.

### Immigration or Machinery—Which?

"Assurance of legislation still further restricting immigration makes materials-handling by machinery necessarily a growing business. Foundries and the coal mines, in particular, are now buying in increasingly large volume.

"Such hesitation as exists on the part of buyers is due, so the buyers themselves state, to the disturbance of the forthcoming election and the Washington political situation. Financial and business conditions of the country generally, however, are sound and stable."

# The Business Barometer

## *This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments*

**By Theodore H. Price**
Editor, *Commerce and Finance*, New York

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AT PRESENT, as is often the case, Wall Street is the most lugubrious place in the United States, if not in the world. But the pessimism is chiefly due to the fact that the stockbrokers are not making money because no one is speculating. This is a good rather than a bad sign, for it means that people are attending to their business and learning again that,

"Early to bed and early to rise,
Work like hell and economize"

is the only rule by which they can become really healthy, wealthy and wise. This homely old saw is quoted because it is time that business shook off the miasmatic fog with which a moribund Stock Exchange is able to envelop the whole country because all the daily papers give so much space to its reports.

As a matter of fact these reports are no longer barometric or significant. But few of the great investment bankers who sell hundreds of millions of new securities each week are members of the Stock Exchange. They deal direct with the thousands of banks and private bankers who have access to the investors and as marginal speculation is more and more discouraged and disparaged, it is not surprising that thirty Stock Exchange firms have either retired or combined since the first of the year.

As to the nation's trade, it is impossible to believe that it is poor or even subnormal. The bank clearings for the week ending May 10 as reported by the *Financial Chronicle* were 4 per cent over the corresponding week in 1923. The debits to individual accounts for the week ending May 7 as reported to the Federal Reserve Board showed an increase of 6.2 per cent over last year.

These figures are the truest measures of business activity that can be had. When the dullness of speculation is taken into account, they give the lie to those who assert that we are entering upon a period of business paralysis. Their testimony to the contrary is abundantly confirmed by much other evidence. If the retail trade is not active, then the statistics compiled by the Federal Reserve Banks are in error and the reports of the mail order houses and the parcels post business must be wrong, for they both show large increases over last year.

Even the widely advertised idleness of the textile industry appears to have been exaggerated, for the Census figures indicate that our domestic cotton consumption in April was only 17 per cent under last year whereas a much larger decrease had been inferred from the calamitous generalizations that have been so widely published. Conditions in Europe are meantime improving. The French elections mean an end of Poincare's militaristic and vindictive policy. The outlook for an acceptance of the Dawes' plan is correspondingly improved.

The Labor government of Great Britain has received what is practically a vote of confidence in Parliament by which Ramsay Macdonald will be greatly helped in his efforts to bring order out of economic chaos. The action of the Federal Reserve Advisory Council in recommending that the Federal Reserve System "should find ways and means to permit our excessive banking strength to benefit other countries" is another step toward making an American market for a huge German loan that will have a revivifying influence upon world trade.

The plethora of bank credits in the United States is attested by the weekly statement of the Federal Reserve System which shows a reserve ratio of 83 per cent, as well as by the statement of our foreign trade for April, which shows an excess of $19,000,000 in merchandise exports and gold imports amounting to $44,000,000. Meantime our merchants continue to buy from hand to mouth. There are no excessive stocks anywhere, unless they are to be found with some manufacturers, which is doubtful, and the railroads are moving a traffic which is as large as last year's in so far as most commodities except coal are concerned.

In the situation thus depicted, there is nothing to justify alarm and so much to encourage confidence that it seems in order to call attention to another old business proverb which urges the wisdom of buying when everyone wants to sell.

The slackening of building activity has been noticeable during the past week.

### *What's Doing in Industry*

**Some gains are reported in the sales markets of machinery and machine tools this week but business is still below estimates made during the first weeks of the year. Most dealers are inclined to think that an even tenor will be maintained from now on until fall when business will again be brisk in most lines.**

**Automobile production is being kept up to a reasonable pace. Figures for the first half of the year will probably compare favorably with those of the same period last year and many manufacturers are predicting a year's total as large or possibly a trifle larger than that of 1923.**

**While iron and steel production is off, it does not constitute a serious condition. Business during the first quarter easily takes up the slack of the second. Fabricators declare that if business during the last half of the year is on a par with the first half, the total will result in a year of excellent business.**

**The electrical goods makers are all busy and there does not seem to be any slackening in any of the lines.**

**Building figures are down from the peak of the year and this is due to the absence of industrial building at this time.**

**Car loading showed an improvement for the first week in May. If coal were moving forward at a normal rate the car loadings would be equal to or better than last year.**

**The stock market is in a bad way but doesn't seem to influence the rest of the country particularly. Trading is so dull that it is practically impossible to learn any definite trend either bullward or bearward.**

## Japan Buys Canadian Freight Cars

The British Government has accepted the tender of a Montreal firm on 47,000 tons of unassembled freight car materials manufactured in Canada during the war for the Russian Government by the Canadian Car & Foundry Co. and the Eastern Car Co. The materials have been lying at different points in Canada, chiefly at Vancouver, since 1917.

The cars will be rebuilt by the Montreal firm for export to Japan. Four thousand cars, having a resale value of around $6,000,000, thus will be reconditioned. The work will commence in a month.

# The Industrial Review

## *Progress of the machinery and machine-tool business in various parts of the country*

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

### Indianapolis

The demand for tools is quiet and the machinery demand seems somewhat spotted. With the machinery houses here, there is both good and bad business, depending on the nature of the machinery. Specialized machines designed for the steel trade are not moving. Lathes, punches, drills and like pieces are not in demand either.

It is doubtful if the automobile plants here are working more than fifty per cent of normal. Naturally any demand for machinery and tools from this source has been cut considerably. The demand for woodworking machinery has been curtailed on the part of the furniture factories.

Many mines in the coal fields are making repairs and adding machinery to their plants, it is reported. It is doubtful if ever since 1919 there has been the demand from brick factories for new machinery as has been seen this year.

Demand for machinery for oil drilling and production in the south central portion has quieted down after a good volume during the winter.

### Southern District

Slight improvement during the first ten days of May over the corresponding period in April is reported by larger distributors of machine tools and equipment in the Atlanta territory.

The April volume was better with larger dealers than last year, although considerably less than either February or March.

The trade considers the outlook fair, and is looking for a steady improvement during May, with summer sales fairly brisk.

Quickening of demand for heavier equipment from railroads has been noted during the past few days, with the lumber, woodworking, and larger machine shops the largest buyers at this time.

The textile industries are still quite inactive, with the future uncertain. Little business has been reported in this field during the past three months.

Heavy demand is reported for road building equipment as the season advances, with sales fairly heavy in nearly all Southern states, and substantially better than at this time last season. In fact, the outlook gives promise of the best year Southern dealers have enjoyed in the past decade in road building equipment sales.

Export trade has improved considerably, with larger Southern agencies reporting heavy bookings out of Southeastern ports, due to the fact that manufacturers are making a stronger bid for this business because of the lull in domestic sales. England, Continental Europe and the Orient are reported fairly good buyers, with some business in Cuba and other Latin-American countries.

### Detroit

May's business in the machinery and machine tool field has far outdistanced that of the entire month of April, according to a survey of conditions in Detroit and vicinity.

April was the smallest month of the year. By May 10 the sales totals of every leading concern had eclipsed the previous month's record.

Automobile production for this month will average from 10 to 20 per cent higher than during April, and there is everywhere manifest a more settled condition with a return to the normal status of affairs. A disposition to let matters take their course on the part of machinery men has already had its influence, and manufacturers are buying without the fear which characterized purchasing several weeks ago.

A noticeable increase in industrial activity in all lines has featured the past week. Several of the larger automotive plants have taken steps to rush through building programs where some time ago they proceeded rather cautiously.

### New York

No improvement is noted in the machinery and machine tool trade in the New York district this week. Business is still better than during April, but the volume is not healthy and the number of inquiries has fallen below the average of the previous month. This condition presages a further dull period and is not encouraging to the dealers of the district.

Most of the complaint comes from those dealers who sell to railroads. Except for single orders occasionally placed they can see no business in sight from this source for some little time. Other dealers report that replacement sales to automobile accessory makers and general industrials are about normal with little hope that any big buying will take place until next fall. The big electric companies are good customers at this particular time, but mostly for only certain classes of special or heavy machinery.

With inquiries off and sales down to necessities, no one in this part of the country is making predictions for the future.

Exporting is better and will probably continue to improve during the summer months.

The used machine tool business is fairly good with the same situation prevailing this week as last, to wit: more orders than machines of the right type availablc.

### Milwaukee

The barest necessities seem to govern the call for metalworking equipment. The volume of sales so far in May by dealers in this market has not fallen below April averages, but the sustaining power has been the purchase of light equipment and used tools by the smaller metalworking shops and automobile repairers. The larger industries are making some replacements but in the main it is indicated by the character of purchases that no attempt is being made to effect any increase of capacity.

Foundries, which have been working at top speed throughout the winter to cope with delivery specifications from the automobile industry, have slowed down their schedules. The same holds true of machine shops which specialize in original stock equipment for passenger car manufacturers. Consequently there is little fresh tool purchasing from these sources. The buying of materials and supplies by railroads has not shown any decline, but no improvement is discernible.

Manufacturers of electrical devices, appliances and similar goods are maintaining the favorable operating schedules of recent months and retailers report the same satisfactory outlet as before.

Builders of woodworking machinery are keeping busy, but new business is not developing at the high rate of the past year. Major requirements evidently have been covered for the present among automobile body builders and manufacturers of lumber and interior woodwork.

### Canada

Reports from most parts of Canada indicate that while the demand for machinery and machine tools is chiefly in small lots, buyers are fairly numerous and inquiries are improving. There is quite an active demand for lathes and drills, especially for automobile repair plants in eastern Canada. There is also a fairly steady demand from the electrical, railroad and mining interests. Further large orders have been placed by the Canadian National Railways with the Canadian Locomotive Co., Ltd. These are for six locomotives of the mountain type, the "6,000" series, and for two large Vanderbilt tenders.

Further reductions in the tariff were made in amendments to the budget

resolutions on May 12. Ingot moulds for the production of steel, reduced from 10 to 7½ per cent on April 30, have now been added to the free list.

Grave fears continue to be expressed by automobile manufacturers as to the probable effect of the British decision to abolish the ad valorem duty of 33⅓ per cent on imported automobiles, giving the United States manufacturers a decided advantage over Canadian makers. The importance of such a step to Canada can quickly be determined when it is borne in mind that the companies engaged in the industry in the Dominion on Jan. 1 last had an investment of $56,028,616, and a total production in the past year of $29,454,793, of which the United Kingdom purchased $6,632,681 worth or more than 20 per cent of the total production.

Car loadings during the past two weeks, show an increase of 0.6 per cent over the corresponding period last year, indicating that more goods are moving in Canada despite a falling off in loadings handled by Canadian lines originating in the United States.

In the steel and iron trades, manufacturers report some large orders for railway equipment and structural steel. Otherwise these lines are fairly quiet.

## Plans Complete for the A.S.T.M. Meeting

The twenty-seventh annual meeting of the American Society for Testing Materials will be held at the Chalfonte-Haddon Hall, Atlantic City, N. J., during the week of June 23. Registration will start Monday, June 23. Monday afternoon and evening and Tuesday morning have been reserved for committee meetings.

A notable departure is being made this year by the Committee on Papers in the arrangement of the program by which parallel sessions will be held practically throughout the meeting, beginning Tuesday afternoon, June 24, and closing on Friday evening, June 27. There will be no meetings of the Society on any afternoon after Tuesday, these periods being left open for committee meetings and for recreation. The meeting will be held in fourteen sessions. Two sessions will be held simultaneously at all periods while the Society is meeting except on Wednesday and Thursday evenings when there will be general sessions. At the Wednesday evening session the President's address will be presented, followed by the annual smoker and dance. The general session on Thursday evening will be devoted to Testing.

## Cost of Living Takes a Drop

The cost of living in the United States on April 15, 1924, had decreased nine-tenths of one per cent from the level of March 15, 1924, as shown by a survey just completed by the National Industrial Conference Board. The most important changes within the month from March to April were decreases of approximately two per cent in food prices and three per cent in fuel prices. Between July, 1920, when the peak of the rise in the cost of living since 1914 was reached, and April, 1924, the cost of living decreased twenty and nine-tenths per cent. The increase in the cost of living since July, 1914, was sixty-one and eight-tenths per cent.

## Cost Accounting Plan of U. S. Chamber

The Department of Manufacture of the Chamber of Commerce of the United States announces the development of a new plan for the conduct of cost accounting activities within individual industries. E. W. McCullough, manager of the department, in making public the accomplishment, says:

"It is of importance that the members of any manufacturing industry develop cost accounting principles, which when applied by individual members of the industry will result in correct costs. Where there is an adequate knowledge of cost, competition is on a better informed basis, and all parties at interest—the manufacturer, his customers and his employees, gain.

"Heretofore activities within trade associations in connection with cost accounting have been carried on without a back-ground of experience, and with no time-tested plan available that will make success certain."

The plan is now ready, as set forth in three pamphlets prepared by the Department of Manufacture under the general title of "Uniform Cost Accounting in Trade Associations." No. 1 is under the title "Organization of Activities"; No. 2, "The Work of the Cost Committee," and No. 3, "Acceptance and Installation." All three divisions of the plan are now available.

## This Man Is Not With Cincinnati Milling

According to an announcement sent out by the Cincinnati Milling Machine Co., Cincinnati, Ohio, a man using the names, "James McGuire," "Bob Gorman," and "James Burns" has been representing himself as an employee of the company and borrowing money on the strength of this from agents and factory representatives of the Cincinnati Milling Machine Co. as well as other concerns. He is said to be about fifty years old, 6 feet tall, and 240 lb. in weight. Efforts are being made to apprehend this fraudulent representative, and co-operation on the part of other machine tool men will be appreciated.

# Business Items

The McDonnell and Brannen Co. has been incorporated at Boliver, New York, by William J. Brannen, H. J. McIntyre and Walter Sherwood, with a capital of $350,000 and will continue the operation of a machine and repair shop.

The National Industrial Conference Board has moved from 10 East 39th St. to 247 Park Ave., New York City.

The output of General Motors of Canada, Ltd., in 1923, exceeded 50,000 cars, of which 27,000 cars were exported. The payroll exceeded $6,000,000. In addition to complete cars exported, motors, axles and other units were sent to the General Motors, Ltd., of England, in the city of London, for the assembly plant at Hendon.

Jones, McNealy & Co., Inc., of Illinois, capitalized at $200,000, has been authorized to manufacture and deal in tools and machinery in the state of Indiana. The company has an Indiana capital of $200,000. The Indiana agent is Kenneth MacNeal, 111 S. High St., Warsaw, Ind.

E. Borgerson & Co., Wellsboro, N. Y., have moved to 86 West Erie Ave., Corning, N. Y.

The Hudson Motor Car Co. has purchased the Jefferson Forge Products Co., Detroit, which has been idle for some time. The property is located across from the Hudson plant.

The Connecticut Belting Co., Norwich, Conn., has been incorporated.

# Obituaries

ALEXANDER ROBERTSON died recently at his home in Welland, Ontario. He was president for many years of Robertson's Machine Works.

A. J. ROSS, aged 59 years, of Bowling Green, Ohio, traveling manager for the Henry Furnace & Foundry Co. of Cleveland, Ohio, fell dead recently in the business district of Indianapolis.

C. E. CARSON, who served as chief transportation officer of the American Expeditionary Forces in France, died at the rehabilitation hospital of the National Home for Disabled Soldiers in Milwaukee from the effects of service on May 9. He resigned as general superintendent of the Colorado & Southern Railway at the beginning of the war and was commissioned a major of engineers. Upon his return from France he became superintendent of the Chicago Great Western Railway, but was compelled to retire in the spring of 1923 because of illness contracted in service.

FRANK C. CALDWELL, formerly president and until 1922 treasury of the National Metal Trades Association, died recently in Chicago.

# Personals

MALVERN S. JONES, formerly with the American Blower Co., Detroit, Mich., is now in charge of the sales in the Michigan territory for the Chicago Pneumatic Co., New York. His headquarters are in Detroit.

F. H. ROBB has been appointed superintendent of the auto service department of the Westinghouse Electric & Manufacturing Co. with headquarters at Springfield, Mass.

WILLARD C. LIPE, formerly vice-president of the Brown-Lipe-Chapin Co., Syracuse, and who has been ill at the Battle Creek sanitorium, is reported improved.

F. W. MCINTYRE has been elected vice-president of the Reed-Prentice Co., Worcester, Mass. Mr. McIntyre is also sales manager.

J. H. WOOD has organized an auction house in Philadelphia for new and used machinery sales. His offices are located at 830 Commercial Trust Building.

J. R. WALRAVEN, vice-president of the Walraven Machinery Co., Atlanta, Ga., has assumed the additional duties of general manager, succeeding the late J. C. Walraven, who died in April.

ARTHUR T. FORSYTH will have charge of the newly opened Western office of the Buffalo Forge Co., Buffalo, N. Y. His headquarters will be located in Seattle, Wash., and his territory will include Washington, Oregon, Idaho, Montana and Alaska.

EDMUND LANG was re-elected president of the Crocker-Wheeler Co., Ampere, N. J. The other officers re-elected are: Arthur L. Doremus, vice-president; Herbert C. Petty, secretary; Theodore Fuller, treasurer; and George W. Bower, assistant secretary and treasurer. Mr. Fuller and Mr. Petty were added to the board of directors.

A. H. ANDERSON will have charge of the newly opened Cleveland office of the Leland-Gifford Co., Worcester, Mass. His headquarters will be at 5,905 Carnegie Ave. and his territory will be the state of Ohio.

F. T. AGTHE, formerly with the Pittsburgh office of the Worthington Pump & Machinery Corp., is now with the Pittsburgh office of the Allis-Chalmers Co., Milwaukee.

FELIX KREMP is now the metallurgist with the Anchor Drawn Steel Co., Latrobe, Pa. He was formerly with the Whitman & Barnes Co., Akron, Ohio.

W. C. DAVIS, formerly president of the Davis Watkins Dairymen's Manufacturing Co., Chicago, has become vice-president of the Foote Bros. Gear & Machine Co., Chicago, Ill.

MAJ. FREDERICK S. LAWRIE, sales engineer for various manufacturers in automobile and railroad equipment and supplies, has been appointed manager of a new branch office established at Detroit, in the General Motors Building, by the South Side Malleable Casting Co. of Milwaukee.

C. T. BRYANT, assistant engineer of maintenance of way of the New York Central system stationed at Wabash, Ind., has been transferred to Cincinnati. He will be in the chief engineer's office there.

A. C. MELANSON has been appointed acting superintendent of the Canadian National Railway Shops at St. Malo, Quebec. Mr. Melanson was formerly stationed at Moncton, N. B., and more recently at Toronto.

WILLIAM R. TOPPAN, formerly with the Graver Co., East Chicago, Ind., is now the manager of the railway department of the Conveyors' Corp. of America, Chicago.

## Increase Shown in Car Loading

Car loadings for the week of May 3 totaled 914,040, according to the Car Service Division of the American Railway Association. Although these loadings are 47,577 cars fewer than for the same week in 1923, they show a distinctly upward turn compared with the previous week, when the total was approximately 84,000 cars under the record for the same period of 1923.

This speeding up of business handled by the railroads was due principally to the increased movement of grain and grain products, ore and miscellaneous freight, while the coal shipments also were slightly heavier than for the week before.

## Trade Catalogs

**Electric Furnaces.** The General Electric Co., Schenectady, N. Y. Direct heat electric furnaces as they are now used in the General Electric plants are shown by a series of illustrations in this booklet.

**Cold Cutting-off Saws.** The Earle Gear & Machine Co., 4707-4715 Stenton Ave., Wayne Junction, Philadelphia, Pa. Halftone illustrations, sectional drawings, diagrams, tables, specifications and text are all used in this catalog to describe the products made by this company.

**Leather Belting.** The Chas A. Schieren Co., New York City. "Nothing Takes the Place of Leather" is the title of an attractive booklet that has recently been mailed out by this company. The history of leather and its many improvements and uses are told in a story that brings the hide and tanning process through their many stages to their final usage.

**Electric Hoists.** The American Engineering Co., Philadelphia, Pa. The mono-rail electric hoist that operates with the minimum headroom and which is trade named "LO-Hed" is described in this folder. Illustrations show its practicability.

**Concrete Driveways.** The Porland Cement Association. Concrete driveways for industrial traffic is the subject discussed in this booklet that has been issued by the cement association with branch offices in all large cities. Illustrations show several different places where these driveways have met with exceptional success.

**Heating Systems.** The Dwyer Equipment Co., 4534 W. North Ave., Chicago, Ill. Improved heating for industrial buildings at a minimum cost is the subject treated in this booklet. The many problems facing the industrialist on this important phase of factory management are discussed.

**Blast Gates.** The W. S. Rockwell Co., 50 Church St., New York City. The Rockwell Air-Tight Blast Gates are described in a new twelve-page folder that has been issued. Letters from satisfied users and illustrations of the product are included.

**Resistance Starters.** The Allen-Bradley Co., Milwaukee, Wis. The alternating current resistance starters and other products made by this company are described in a series of four catalogs suitable for filing that have recently been issued. Charts, graphs and text are combined to tell the story adequately.

**Air Compressors, Vacuum Pumps and Spaders.** The Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill. Four bulletins have been published by this machinery company on the subjects enumerated above. All of the bulletins are perforated ready for filing and are of the same size as the ones usually sent out by this company. Each is complete on the subject embraced.

**Dies.** The Diamant Tool & Manufacturing Co., 91-97 Runyon St., Newark, N. J. This folder tells of the products that are made by this company. It is attractively illustrated and contains interesting text and tables.

**Shapers.** Gould & Eberhardt, Newark, N. J. High duty shapers and attachments that are made by this firm are described and illustrated in a handy little booklet that has just been issued.

**Shaft Coupling.** The Ajax Flexible Coupling Co., Westfield, N. Y. The features of this product are told by text and illustration in a booklet that contains a blue print with dimensions and prices and other information regarding the coupling.

## Export Opportunities

**The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.**

Industrial machinery of various kinds. Melbourne, Australia. Agency. Reference No. 10,153.

Woodworking machinery and tools and equipment for mills. Wellington, New Zealand. Purchase and agency. Reference No. 10,182.

Woodworking and veneer-making machinery. Lodz, Poland. Purchase. Reference No. 10,181.

## Forthcoming Meetings

**American Society of Mechanical Engineers.** Spring meeting. Cleveland, Ohio. May 26, 27, 28 and 29. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

**Southern Supply & Machinery Dealers Association, National Supply & Machinery Dealers Association, and American Supply & Machinery Manufacturers Association.** Triple convention, May 19, 20 and 21, 1924. Hotel Cleveland, Cleveland, Ohio. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

**National Association of Purchasing Agents.** Annual Convention, Mechanics Hall, Boston, May 20, 21, 22 and 23. W. L. Chandler, secretary, 19 Park Place, New York City.

**Foreign Trade Council.** Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

**Gas Products Association.** Tenth annual meeting, June 10, 11 and 12. Ambassador Hotel, Atlantic City, N. J. C. T. Price, secretary and treasurer, 140 S. Dearborn St., Chicago, Ill.

**The General Committee of Division V, Mechanical of the American Railway Association.** Convention and exhibits. Atlantic City, June 11-18, 1924. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

**Railway Supply Manufacturers Association.** Exhibit. Atlantic City, June 11-18, 1924.

**American Society for Testing Materials.** Twenty-seventh annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. Week of June 23. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

**Society of Automotive Engineers.** Summer Meeting. June 24, 25, 26 and 27. Spring Lake, N. J. C. F. Clarkson, secretary, 29 W. 39th St., New York City.

**American Society for Steel Treating.** Sixth Convention, Boston, Mass., Sept. 22, 23, 24, 25 and 26. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

**American Foundrymen's Association.** Twenty-eighth annual convention. Milwaukee, Wis. Week of Oct. 13, 1924.

**Management Week.** Under the auspices of the American Society of Mechanical Engineers. Week of Oct. 20, 1924. New York City.

# The Weekly Price Guide

## Rise and Fall of the Market

**Iron and Steel**—Pig iron inquiries continue to increase in volume; price of No. 2 f'd'y, firm at $22@$23 per ton, Birmingham. Steel scrap market considerably firmer in tone. Jobbers' discounts on bolts, nuts, etc., increased; reflecting recent change at mill. Tin plate inquiry better; general tone of steel market improved. Price of steel bars is now $2.20@$2.30 per 100 lb., Pittsburgh; shapes, $2.10@$2.25 and plates, $2@$2.25 per 100 lb.

**Non-Ferrous Metals**—Copper at new low since decline started in February; domestic inquiry fair; present downward trend reflects condition in foreign markets. Tin market universally weak. Lead position good despite recent decline of $5 per ton; demand active; output near capacity. Zinc prices steady; small demand. Antimony firm at present level.

(All prices as of May 16)

## IRON AND STEEL

**PIG IRON**—Per gross ton—Quotations compiled by The Matthew Addy Co.:

| | |
|---|---|
| CINCINNATI | |
| No. 2 Southern | $25.05 |
| Northern Basic | 24.00 |
| Southern Ohio No. 2 | 24.00 |
| NEW YORK—Tidewater Delivery | |
| Southern No. 2 (silicon 2.25@2.75) | 28.00 |
| BIRMINGHAM | |
| No. 2 Foundry | 22@23 |
| PHILADELPHIA | |
| Eastern Pa., No. 2x (silicon 2.25@2.75) | 24.25 |
| Virginia No. 2 | 28.17 |
| Basic | 24.00 |
| Grey Forge | 24.00 |
| CHICAGO | |
| No. 2 Foundry local | 24.50 |
| No. 2 Foundry, Southern (silicon 2.25@2.75) | 27.00 |
| PITTSBURGH, including freight charge from Valley | |
| No. 2 Foundry | 25.77 |
| Basic | 25.77 |
| Bessemer | 26.77 |

**IRON MACHINERY CASTINGS**—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

| | |
|---|---|
| Detroit | 4.75 |
| Cleveland | 4.75@5.00 |
| Cincinnati | 5.00@7.50 |
| New York | 5.00@5.50 |
| Chicago | 5.25@5.75 |

**SHEETS**—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

| Blue Annealed | Pittsburgh | New York | Cleveland | Chicago |
|---|---|---|---|---|
| No. 10 | $2.80@3.00 | 4.34 | 3.65 | 4.00 |
| No. 12 | 2.90@3.10 | 4.39 | 3.70 | 4.05 |
| No. 14 | 3.00@3.20 | 4.44 | 3.75 | 4.10 |
| No. 16 | 3.20@3.40 | 4.54 | 3.85 | 4.20 |
| Black | | | | |
| Nos. 17 and 21 | 3.70 | 4.65 | 4.35 | 4.55 |
| Nos. 22 and 24 | 3.75 | 4.70 | 4.40 | 4.55 |
| Nos. 25 and 26 | 3.80 | 4.75 | 4.45 | 4.60 |
| No. 28 | 3.85 | 4.85 | 4.55 | 4.70 |
| Galvanized | | | | |
| Nos. 10 and 11 | 3.80@4.00 | 4.90 | .... | 4.60 |
| Nos. 12 and 14 | 3.90@5.10 | 5.00 | .... | 4.70 |
| Nos. 17 and 21 | 4.20@4.40 | 5.30 | .... | 5.00 |
| Nos. 22 and 24 | 4.35@4.55 | 5.45 | 5.10 | 5.15 |
| No. 26 | 4.50@4.70 | 5.55 | 5.35 | 5.30 |
| No. 28 | 4.80@5.00 | 5.85 | 5.65 | 5.60 |

**WROUGHT PIPE (Welded)**—Warehouse discounts are as follows:

| | New York Black | New York Galv. | Cleveland Black | Cleveland Galv. | Chicago Black | Chicago Galv. |
|---|---|---|---|---|---|---|
| 1 to 3 in. steel butt welded | 48% | 34% | 55½% | 43½% | 50% | 37% |
| 2½ to 6 in. steel lap welded | 44% | 30% | 53½% | 40½% | 47% | 34% |

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%, less 5%; class A, plus 23%. Cast iron, standard sizes, 34@5% off.

**SEAMLESS STEEL TUBING**—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0,17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

| O.D. Inches | List Price per ft. | Differential Discount | O.D. Inches | List Price per ft. | Differential Discount |
|---|---|---|---|---|---|
| ¼ | $0.09 | 50% | ⅞ | $0.16 | 35% |
| ⅜ | .11 | 45% | 1 | .18 | 31% |
| ½ | .14 | 40% | | | |

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

**MISCELLANEOUS**—Warehouse prices in cents per pound in 100-lb. lots:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Open hearth spring steel (base) | 4.50 | 6.00 | 4.20 |
| Spring steel (light) (base) | 7.00 | 6.00 | 6.00 |
| Coppered Bessemer rods (base) | 6.53 | 8.00 | 6.70 |
| Hoop steel | 5.19 | 4.66 | 4.55 |
| Cold rolled strip steel | 7.50 | 8.25 | 7.40 |
| Floor plates | 5.80 | 5.66 | 5.80 |
| Cold drawn shafting or screw | 4.40 | 4.10 | 4.00 |
| Cold drawn flats, squares | 4.90 | 4.60 | 4.50 |
| Structural shapes (base) | 3.59 | 3.46 | 3.30 |
| Soft steel bars (base) | 3.49 | 3.36 | 3.20 |
| Soft steel bar shapes (base) | 3.49 | 3.36 | 3.20 |
| Soft steel bands (base) | 4.39 | 3.61 | 3.95 |
| Tank plates (base) | 3.59 | 3.46 | 3.30 |
| Bar iron (3.00 at mill) | 3.49 | 3.36 | 3.20 |
| Tool steel | 11.00 | .... | .... |
| Drill rod (from list) | 60% | 40@55% | 50% |

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

## METALS

Current Prices in Cents Per Pound

| | | | |
|---|---|---|---|
| Copper, electrolytic (up to carlots), New York | | | 13.50 |
| Tin, 5-ton lots, New York | | | 44.50 |
| Lead (up to carlots), St. Louis | 7.12½ | New York | 7.87½ |
| Zinc (up to carlots), St. Louis | 5.90 | New York | 6.87½ |

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Aluminum, 98 to 99% ingots, 1-15 ton lots | 27.00 | 30.00 | 28.50 |
| Antimony (Chinese), ton spot | 8.75 | 11.00 | 10.00 |
| Copper sheets, base | 20.25 | 20.75@21.00 | 23.00 |
| Copper wire, base | 15.50 | 18.75 | 16.25 |
| Copper bars, base | 19.25 | 22.00 | 19.50 |
| Copper tubing, base | 22.25 | 27.00 | 23.00 |
| Brass sheets, base | 16.75 | 21.50 | 18.75 |
| Brass tubing, base | 21.00 | 26.50 | 20.50 |
| Brass rods, base | 14.50 | 17.50 | 15.75 |
| Brass wire, base | 17.25 | 21.50 | .... |
| Zinc sheets (casks) | 10.75 | 11.00 | .... |
| Solder (½ and ½), (case lots) | 37.00 | 34.50 | 30.00 |
| Babbitt metal (83% tin) | 60.00 | 58.00 | 48@52 |
| Babbitt metal (35% tin) | 28.00 | 19.50 | 23@26 |
| Nickel (ingot and shot) f.o.b. refinery | 27.00 | .... | .... |
| Nickel (electrolytic) f.o.b. refinery | 30.00 | .... | 35.00 |
| Nickel (F shot) f.o.b. refinery | 30.00 | .... | .... |

**SPECIAL NICKEL AND ALLOYS**—Price in cents per lb., f.o.b Huntington, W. Va.:

| | |
|---|---|
| Rolled nickel sheet (base) | 52.00 |
| Hot rolled rods, Grade "A" (base) | 50.00 |
| Cold drawn rods, Grade "A" (base) | 58.00 |

# Shop Materials and Supplies

## METALS—Continued

Manganese nickel hot rolled rods "E"—low manganese (base) 54. 00
Manganese nickel hot rolled rods "D"—high manganese (base) 57. 00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

| | | | |
|---|---|---|---|
| Shot | 32. 00 | Hot rolled rods (base) | 40. 00 |
| Blocks | 32. 00 | Cold drawn rods (base) | 48. 00 |
| Ingots | 38. 00 | Hot rolled sheets (base) | 42. 00 |

**OLD METALS**—Dealers' purchasing prices in cents per pound:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Copper, heavy, and crucible | 10.00@10. 75 | 10. 50 | 10. 75 |
| Copper, heavy, and wire | 9. 62½@10. 50 | 10. 00 | 10. 00 |
| Copper, light, and bottoms | 7. 62½@9. 50 | 8. 50 | 9. 00 |
| Lead, heavy | 5. 62½@7. 50 | 6. 00 | 6. 50 |
| Lead, tea | 3. 37½@6. 25 | 3. 50 | 5. 50 |
| Brass, heavy, yellow | 4. 87½@6. 75 | .. .. | 6. 50 |
| Brass, heavy, red | 7. 12½@9. 00 | 9. 00 | 8. 50 |
| Brass, light | 4. 12½@5. 75 | 5. 00 | 6. 00 |
| No. 1 yellow brass turnings | 4. 12½@6. 75 | 6. 00 | 6. 50 |
| Zinc | 3. 50 @3. 75 | 3. 50 | 3. 50 |

**TIN PLATES**—American Charcoal—Bright—Per box.

| | | New York | Cleveland | Chicago |
|---|---|---|---|---|
| "AAA" Grade: | | | | |
| IC, | 20x28, 112 sheets | $24. 30 | $22. 85 | $18. 50 |
| "A" Grade: | | | | |
| IC, | 20x28, 112 sheets | 20. 20 | 18. 00 | 17. 00 |
| | Coke Plates—Primes, 20x28 in. | | | |
| 100-lb., | 112 sheets | 14. 00 | 13. 00 | 14. 50 |
| | Terne Plates—Small lots, 8-lb. Coating | | | |
| IC, | 14x20 | 8. 25 | 6. 55 | 7. 40 |

## MISCELLANEOUS

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Cotton waste, white, per lb. | $0. 14@0. 21 | $0. 20 | $0. 14 |
| Cotton waste, colored, per lb. | . 09@ .12½ | .17 | . 10½ |
| Wiping cloths, 13¼x13¼, per lb | 11. 50 | 36. 00 per M | . 16 |
| Wiping cloths, 13¼x20½, per lb. | .... | 52. 00 per M | . 16 |
| Sal soda, per 100 lb. | 2. 40 | 2. 25 | 2. 65 |
| Roll sulphur, per 100 lb. | 3. 60 | 3. 25 | 3. 50 |
| Linseed oil, per gal., 5 bbl. lots | . 98 | 1. 07 | . 94 |
| Lard cutting oil, 25% lard, per gal. | . 55 | . 50 | . 79* |
| Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal. | .29 | . 35 | . 40 |
| Belting—Present discounts from list in fair quantities (½ doz. rolls). | | | |
| Leather—List price, 2c. per sq.in., per ply: | | | |
| Medium grade | 40–2½% | 30–10% | 30–10% |
| Heavy grade | 30–5% | 30% | 20–5–2½% |
| Rubber and duck: | | | |
| First grade | 50% | 50–10% | 40–10% |
| Second grade | 50–5% | 60–5% | 60–5% |
| Abrasive materials—In sheets 9x11 in.. | | | |
| No. 1 grade, per ream of 480 sheets: | | | |
| Flint paper | $5. 40 | $5. 84 | $6. 48 |
| Emery paper | 9. 90 | 11. 00 | 8. 80 |
| Emery cloth | 31. 12 | 31. 12 | 29. 48 |
| Emery disks, 6 in. dia., No. 1 grade, per 100: | | | |
| Paper | 1. 49 | 1. 24 | 1. 40 |
| Cloth | 3. 38 | 2. 67 | 3 20 |
| Fire clay, per 100 lb. bag | .... | . 65 | . 60 |
| Coke, prompt furnace, Connellsville | per net ton | | 3. 75@4. 00 |
| Coke, prompt foundry, Connellsville | per net ton | | 4. 75@5. 50 |
| White lead, dry or in oil | 100 lb. kegs | | New York, 15. 00 |
| Red lead, dry | 100 lb. kegs | | New York, 15. 00 |
| Red lead, in oil | 100 lb. kegs | | New York, 16. 50 |

*Chicago quotes on pure lard oil, No. 1 grade.

## *Comparative Warehouse Prices*

| New York | Unit | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|---|
| Soft steel bars | per lb. | $0 0349 | $0.0349 | $0.0354 |
| Cold finished shafting | per lb. | 0.044 | 0.044 | 0.044 |
| Brass rods | per lb | 0.15 | 0.155 | 0.1875 |
| Solder (½ and ½) | per lb. | 0.37 | 0.39 | 31.50@33.50 |
| Cotton waste | per lb. | .14@.21 | .14@.21 | .10@.13 |
| Washers, cast iron (¼ in.) | per 100 lb. | 6.50 | 6.50 | 6.50 |
| Emery, disks, cloth, No. 1, 6 in. dia. | per 100 | 3.38 | 3.38 | 3.02 |
| Lard cutting oil | per gal. | 0.55 | 0.55 | 0.60 |
| Machine oil | per gal. | 0.29 | 0.29 | 0.297 |
| Belting, leather, medium | off list | 40–2½% | 40–2½% | 30–10% |
| Machine bolts up to 1x30 in. | off list | 50% | 45% | 30% |

## SHOP SUPPLIES

Current Discounts from Standard Lists

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Machine Bolts: | | | |
| All sizes up to 1x30 in. | 50% | 60–10–5% | 55–5% |
| 1½ and 1¼x3 in. up to 12 in. | 15% | 60% | 50% |
| With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%) | 35% | $3. 50 net | ..... |
| With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%) | 45% | 3. 50 net | $4. 00 off |
| Button head bolts, with hex. nuts | List net | List net | 3. 50 |
| Hex. head and hex. nut bolts | List net | .....List plus 10% | |
| Lag screws, coach screws | 50% | ..... | 50–5% |
| Square and hex. head cap screws | 75% | 75% | 75–5% |
| Carriage bolts, up to 1 in.x30 in. | 40% | 60% | 50–5% |
| Bolt ends, with hot pressed nuts | 50% | ..... | 55–5% |
| Tap bolts, hex. head, list plus | 35% | ..... | ..... |
| Semi-finished nuts, 1/16 and smaller | 70% | ..... | ..... |
| Semi-finished nuts, ⅝ and larger | 65% | 70% | 80% |
| Case-hardened nuts | 50% | ..... | ..... |
| Washers, cast iron, ⅜ in., per 100 lb. (net) | $6. 50 | $4. 00 | $4. 00 |
| Washers, cast iron, ⅝ in., per 100 lb. (net) | 5. 50 | 4. 00 | 4. 00 |
| Washers, round plate, per 100 lb. Off list | 1. 50 | 4. 50 | 4. 00 |
| Nuts, hot pressed, sq., per 100 lb. Off list | 1. 50 | 4.00 | 3. 50 |
| Nuts, hot pressed, hex., per 100 lb. Off list | 1. 50 | 4 00 | 3. 50 |
| Nuts, cold punched, sq., per 100 lb. Off list | 1. 50 | 4.00 | 3. 50 |
| Nuts, cold punched, hex., per 100 lb. Off list | 1. 50 | 4.00 | 3. 50 |
| Rivets: | | | |
| Rivets, 7/16 in. dia. and smaller. | 50% | 60–10% | 60% |
| Rivets, tinned | 50% | 60–10% | 4½c. net |
| Button heads ⅞-in., ¾-in., 1x2 in. to 5 in., per 100 lb. (net) | $5. 00 | $3. 50 | $3. 75 |
| Cone heads, ditto (net) | 5. 20 | 3. 60 | 3. 95 |
| 1½ to 2-in. long, all diameters, *EXTRA* per 100 lb. | 0. 25 | ..... | 0. 15 |
| ⅝ in. diameter *EXTRA* | 0. 35 | ..... | 0. 15 |
| ½ in. diameter. *EXTRA* | 0. 75 | ..... | 0. 50 |
| 1 in. long, and shorter *EXTRA* | 0. 75 | ..... | 0. 50 |
| Longer than 5 in. *EXTRA* | 0. 50 | ..... | 0. 25 |
| Less than 200 lb. *EXTRA* | 0. 50 | ..... | 0. 50 |
| Countersunk heads *EXTRA* | 0. 45 | ..... | $4.20 base |

# Machine Requirements and Industrial Construction

## Machine Tools and Equipment Wanted

**Conn., Waterbury**—Plume & Atwood Mfg. Co., 470 Bank St. (manufacturer of brass) —general equipment for proposed addition to plant.

**Conn., Waterbury** — Waterbury Farrel Fdry. & Machine Co., 425 Bank St.—equipment for proposed addition to plant.

**Ky., Louisville**—Office of United States Engineer, P. O. Box 72—one chuck lathe, 21½ in. diameter, 4 jaws, f.o.b. Owensboro; four air drills and two air wood boring machines for general repair station; receiving bids until May 26 for bending rolls, lower 6½ x 62 in., upper 7 x 62 in.

**Md., Baltimore**—Stieff Co., 17 North Liberty St., G. N. Stieff, Pres.—complete machinery and equipment for the manufacture of silverware.

**Mass., Athol**—A. Shaw, 180 Walnut St.—equipment for proposed addition to machine shop.

**Mass., Boston**—Mayfair Mfg. Co., 31 Milk St. (automobiles), A. Hamilton, Purch. Agt. —Heald single purpose cylinder grinder; 8 in. lathe; 21 in. geared head lathe, motor drive, 2 hp.; single lever arbor press; three spindle drill; 1 hp. bench grinder, 8 in. wheel; electric drills, ½ and ¼; air drill, countershaft, 3 speed, Pettingell hammer; ½ ton chain falls; large air compressors.

**Mass., Jamaica Plain** (Boston P. O.)—H. Bettoney, 106 Chestnut St. (manufacturer of musical instruments)—small bandsaw and hand screw machine, Garwin No. 3 or similar.

**Mass., New Bedford**—City, N. Ricard, Chn. Com.—equipment for proposed fire department repair shop.

**Mass., Quincy**—L. Grossman & Sons, 37 Federal Ave. (mill and builders supplies), R. A. Grossman, Purch. Agt.—hoisting machines.

**Mass., Salem**—Salem Terminal Corp.—conveying machinery for coal handling plant.

**Mo., Joplin**—Clark Signal Co., 313 East 3rd St., C. J. Clark, Purch. Agt.—14 in. x 6 ft. lathe and shaper.

**N. Y., Brooklyn**—Empire Tinware Co., 33 South 5th St.—welding machine for seaming.

**N. Y., Buffalo**—H. E. Mallue & Bro., Inc., 1698 Genesee St.—machinery for carpenter shop.

**N. Y., Hoosick Falls**—Colaston Co., R. Wales, Purch. Agt.—5 x 13 in. engine lathe, quick change gear and compound test.

**N. Y., Jay**—Nye Bros. (lumber), W. Nye, Purch. Agt.—planer and matcher, belt driven.

**O., Columbus**—Muth Bros., 207 East Capital St. (house movers and wreckers) —two small cranes and one electric hoisting machine for new warehouse.

**O., Columbus**—No Liquid Door Check Co., 117 West Frankfort St. (manufacturer of door checks), A. J. Bush, Pres.—two 24 in. turret lathes, one drill press and one milling machine.

**O., Columbus**—A. V. Riley & Co., 1233 North High St., O. V. Riley, Purch. Agt.—small lathe and grinder for automobile service station.

**O., Columbus**—Twentieth Century Heating & Ventilating Co., 972 North High St., J. R. Dunn, Mgr.—metal working equipment to enlarge shop.

**O., Dayton**—Bd. Educ., Ludlow Bldg.—receiving bids until June 10 for wood and metal working machinery for Roosevelt High School.

**O., Newcomerstown** — Newcomerstown Lumber Co., C. Lieser, Secy.—motor driven Universal woodworking machine.

**O., Warren**—Amer. Roll & Machine Co.—one overhead crane.

**Pa., Erie**—Northern Equipment Co., 111 West 11th St. (manufacturer of Copes system of feed water controls), V. V. Veenschoten, Supt.—one swing cutoff saw and one drill press, Baker or equal.

**Pa., Grove City**—Bessemer Gas Engine Co.—motor driven planer, 60 x 72 in., 25 ft. long.

**Pa., Grove City**—Pri-co Mfg. & Sales Co. (manufacturer of aluminum and automobile accessories), E. B. Cook, Mgr.—lathes, drill presses, bandsaws and woodworking machinery.

**Pa., Monaca**—Superior Steel Products Co. —5 ton electric crane.

**Pa., Pittsburgh**—R. D. Nuttall Co., Harrison Ave.—15 ton overhead crane.

**Wis., Beloit** — Young Mfg. Co., 1145 Prairie Ave., W. W. Young, Purch. Agt.—woodworking machinery, including planer and sticker.

**Wis., Milwaukee** — Granolite Corp., 224 4th St. (manufacturer of lighting fixtures) —20 to 24 in. drill press and polishing lathes.

**Wis., Milwaukee**—Masco Specialty Co., c/o W. J. Trimborn, 209 Grand Ave.—boring machine and emery grinders for machine shop.

**Wis., Milwaukee**—Smith Eng. Wks., 1154 32nd St. (manufacturer of stone crushing machinery), H. Smith, Secy.—machine tools and equipment.

**Wis., Waupun**—Waupun Auto Sales Co. —tool room lathe for garage.

**Ont., Lindsay**—Sylvester Mfg. Co., Ltd. (manufacturer of railway, gasoline and oil pumping engines, etc.), R. M. Sylvester, Purch. Agt.—small Bliss press and blanking machine.

**Ont., London**—Caloric Furnace Mfg. Co., 691 Bathurst St., S. J. Shibley, Mgr.—foundry and special equipment for the manufacture of furnaces.

## Opportunities for Future Business

**Calif., Los Angeles** — The Mack International Motor Truck Co., 1628 East 7th St., is having plans prepared for the consrtuction of a 1 story, 200 x 450 ft. and 2 story, 200 x 500 ft. service and storage plant on Alameda St. Cost will exceed $350,000. J. M. Cooper, Marsh-Strong Bldg., Archt. Noted Jan. 24.

**Calif., Los Angeles**—H. L. Pierce, Archt., Wright-Callendar Bldg., is receiving bids for the construction of a 1 story, 100 x 125 ft. garage on Pasadena Ave. for the Albertson Motor Co., 1540 South Figueroa St.

**Calif., Los Angeles**—The Westlake Fireproof Garage Co., c/o Noerenberg & Johnson, Archts., Railway Bldg., will build a 6 story, 55 x 150 ft. garage on Westlake Ave. Noted Apr. 10.

**Calif., Vernon** — The Baash-Ross Tool Co., 108 West 2nd St., Los Angeles, awarded the contract for the construction of a 50 x 80 ft. factory, here.

**Conn., New Britain**—The Stanley Rule & Level Co., 111 Elm St., manufacturer of hardware, is having plans prepared for the construction of a 3 story, 60 x 89 ft. addition to its factory. Estimated cost $45,000. Private plans.

**Conn., Waterbury**—The Plume & Atwood Mfg. Co., 470 Bank St., manufacturer of brass, is receiving bids for the construction of a 5 story, 50 x 150 ft. addition to its plant. Estimated cost $100,000. Private plans. Noted Mar. 27.

**Conn., Waterbury**—The Waterbury Farrel Fdry. & Machine Co., 425 Bank St., is having plans prepared for the construction of a 60 x 100 ft. addition to plant, including charging department. Estimated cost $50,000. F. A. Webster, 51 West Main St., Archt.

**Ill., Decatur**—The Wabash Ry., Railway Exch. Bldg., St. Louis, Mo., awarded the contract for the construction of a 1 and 2 story, 190 x 344 ft. and 80 x 450 ft. car shop and storehouse, here. Estimated cost $500,000.

**Ill., Rockford**—The Rockford Brass Wks. awarded the contract for the construction of a factory and foundry. Estimated cost $70,000.

**Ill., Sterling**—The Peerless Level & Tool Co. awarded the contract for the construction of a 1 story, 100 x 127 ft. factory. Estimated cost $50,000. Noted Mar. 27.

**Ind., Jeffersonville**—The Howard Ship Yard plans to build a 55 x 300 ft. machine shop. Cost will exceed $50,000.

**Ky., Louisville**—The Kentucky School for Blind, Frankfort Ave., awarded the contract for the construction of a 2 story, 35 x 108 ft. workshop. Estimated cost $75,000.

**Ky., Louisville**—The Standard Sanitary Mfg. Co., 6th and A Sts., will soon award the contract for the construction of a 1 story, 140 x 180 ft. foundry. Estimated cost $100,000.

**Md., Baltimore**—The Carriage & Toy Co., 636-40 West Pratt St., awarded the contract for rebuilding plant, which was recently destroyed by fire. Estimated cost $40,000.

**Mass., Athol**—A. Shaw, 180 Walnut St., plans to build an addition to machine shop.

**Mass., Boston**—The Union Realty Co., c/o H. F. Livermore, 100 Cummington St., is having plans prepared for the construction of a 2 story, 75 x 240 ft. machine shop on Linden St. Estimated cost $110,000. Private plans.

**Mass., Everett** — The Boston Elevated Ry., Park Sq., Boston, plans to build a repair shop, here.

**Mass., Lawrence**—The city, W. T. Rockefort, Mayor, is having plans prepared for the construction of a 1 and 2 story, 125 x 150 ft. garage, machine shop, etc., on Auburn St. Estimated cost $100,000. J. Broadhurst, 45 Bway., Archt.

**Mass., New Bedford** — The City, N. Ricard, Chm. Com., is having plans prepared for the construction of a repair shop for fire department on Purchase St. Estimated cost $10,000, including equipment. Chase, Pierce & Chase, 6th and Union Sts., Archts.

**Mass., Worcester**—The Worcester Lawn Mower Co., Freemont St., is having preliminary plans prepared for the construction of an addition to its plant. Estimated cost $60,000. Private plans.

**Mich., Detroit**—The Hupp Motor Car Co., 3501 East Milwaukee St., awarded the contract for the construction of a 1 story, 50 x 150 ft. steel-block test building, including machine foundations, also 1 story, 100 x 120 ft. storage building, including overhead craneways. Estimated cost $50,000 and $75,000 respectively.

**Mich., Detroit**—The Unique Brass Mfg. Co., 123 Military St., awarded the contract for the construction of a 1 story, 50 x 50 ft. drop forge building. Estimated cost $15,000.

**N. J., Trenton**—J. A. Roeblings Sons Co., 612 South Broad St., awarded the contract for the construction of a 2 story, 138 x 300 ft. addition to wire mill. Estimated cost $200,000.

**N. Y., Ogdensburg**—The Coplan Steel Co., c/o A. H. Coplan, is receiving bids for the construction of an 85 x 352 ft. foundry. Estimated cost $75,000. Noted Mar. 6.

**N. Y., Tully**—The W. A. Cardner Box Co., Lincon Ave., plans to rebuild its factory, which was recently destroyed by fire. Estimated cost $50,000.